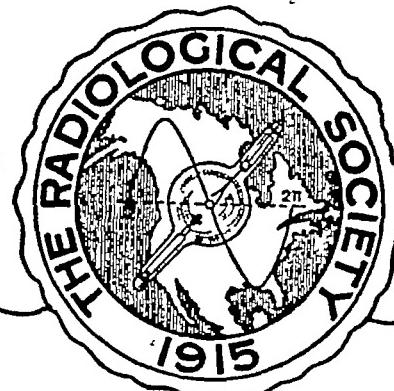
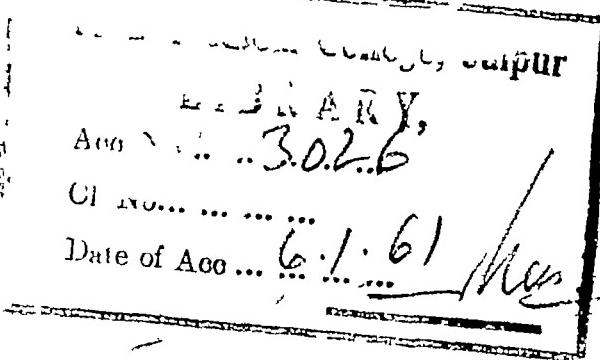


RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Owned and Published by
THE RADIOLOGICAL SOCIETY
OF NORTH AMERICA
As its Official Journal



JUNE, 1932

Volume XVIII

Number 6



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Victor "KX" Valve-Tube X-Ray Apparatus covers entire field of roentgenology

WHATSOEVER the requirements are for x-ray energy sufficient to produce the finest diagnostic chest radiographs in 1/30th to 1/120th of a second, or for x-ray therapy with 30 mri at 200 kv p., or 10 mri at 400 kv p., the Victor "KX" series offers the selection of a unit with which



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It may be said, unequivocally, that never before in the x-ray art has diagnostic apparatus been available with which the x-ray energy was under the control of the operator to the degree now realized in the "KX" series. When we speak of obtaining, as a routine procedure, radiographs of preferred contrast and density, using energies as high as 1000 mri at 85 kv p., with exposures as fast as 1/120th second, it gives a very definite idea of what is now being realized by users of the KX-1 Unit, for instance.

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RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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ANNOUNCING

A New Series "XP" Coolidge X-Ray Tubes

HERE are the outstanding features of the new "XP" series of eight diagnostic Coolidge tubes, the result of extensive research and engineering work.

The "XP" series is representative of all that the science of physics has thus far contributed to the knowledge of x-ray phenomena together with the skill in design and manufacture that follows many years of experience in the production of the world famous Coolidge tube.

By using a 20° anode with an elongated focal spot it is introduced by Benson* in 1916, a smaller projected focus has been made possible thereby offering a choice of increased film detail or greater speed of radiography.

The x-ray protective cover is entirely independent of the vacuum unit or tube proper, thus simplifying construction and increasing the reliability of the latter. Furthermore, economy and convenience are realized when replacement of the tube (vacuum unit only) becomes necessary.

Three different focal spot sizes are available, also a double focus with either air cooled or water cooled radiator. An air cooled model may be converted to water cooled, or vice versa by simply unscrewing one radiator and substituting the other.

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|---|
| X Ray Protection |
| Smaller Focal Spots |
| Higher Energy Ratings |
| Replacement Economy |
| Air and Water-Cooled Radiators Interchangeable |
| Extraordinary Freedom from Risk of Puncture |
| Utmost Reliability Due to Practical Design of Vacuum Unit |

*U. S. Patent No. 1,174,041 granted March 7, 1916. Assigned to General Electric X-Ray Corporation in October 1931.



Above: "XP" Coolidge Tube enclosed in protective cover with water cooled radiator.
Right: Air Cooled Radiator which is interchangeable with above water cooled radiator.
Below: The Coolidge Tube as it appears when supplied as a replacement unit.



Thus the Coolidge tube, the advent of which marked a new era in x-ray science, points to new achievements and higher standards for the immediate future of the art.



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PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA

VOL XVIII

JANUARY, 1932

No 1

LUNG ABSCESS¹

By WILLIAM A. HUDSON, M.D., M.Sc., F.A.C.S., Grace Hospital, DETROIT, MICHIGAN

THE thoracic surgeon, like any other physician who carries on a special type of medical practice, finds that he must have the constant co-operation and support of men occupied with other fields in medicine. The roentgenologist is one upon whom the thoracic surgeon must make frequent demands. The help obtained is more satisfactory if the contact is close and the exchange of ideas is free. Many difficult questions can in this way be solved that would otherwise be forced to await future development for their solution.

Because of our constant association with roentgenologists it is felt that it might be of advantage to record some of our experiences. We will try to point out some of the conditions we have encountered which have proven of value to us in arriving at our conclusion as early as possible.

DEFINITION

By lung abscess, we mean a destructive process in the lung tissue originating within the lung itself as a result of an invasion of the lung by pyogenic micro-organisms. All suppurative processes of the pleural cavity, such as empyema, whether general or

local, and all tuberculous cavities are excluded.

ETIOLOGY

The one etiologic factor common to all lung abscesses is the propagation of pyogenic micro-organisms and their introduction into the lung substance. Any pus-forming micro-organisms, then, may be the etiologic or causative factor. All produce radiological evidence of much the same character. We have noted that lung abscesses produced by certain micro-organisms present some features in a more striking manner than others, for instance, abscesses caused by fuso-spirochetal organisms of Vincent are prone to spread rapidly without regard to fascial planes or lobar boundaries (Case I) and are associated with a foul odor, while abscesses caused by *B. Friedlander* may spread less rapidly—they seem to excavate the lung.

While all lung abscesses present radiological evidence of much the same character, there is, however, such a wide range of findings at different stages in the development of lung abscesses that it is not surprising that difficulty is at times encountered in the diagnosis of such processes. A considerable proportion of the lung abscesses encountered is found to follow some known condition. In certain types of abscesses, i.e., post-ton-

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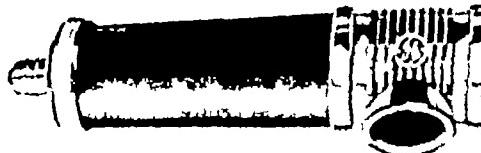
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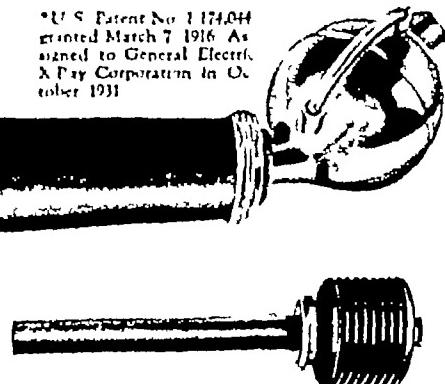
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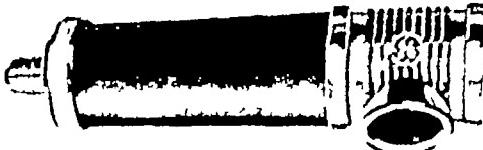
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silectomie, it is possible to definitely establish the date of the onset. Should one follow such a complication through all of its phases one would be able to obtain certain evidence of value.

ROENTGEN EVIDENCE

At the onset of a lung abscess, the formation of which is due to aspiration, infection, and blockage of secretion, the first roentgenographic evidence of abscess formation is the appearance of an area of increased density in the region of the bronchial obstruction. This area of increased density is confined at first to that portion of the lung immediately adjacent to the obstruction and along the bronchial tree distal to the obstruction. The markings of the bronchi distal to the obstruction most frequently appear as radiating lines extending into the periphery of the lung field (Cases II and III). Succeeding studies show extension of the area of increased density until, in time, an entire lobe or more may be involved in the process (Case IV). The speed with which the lesion extends depends upon the virulence of the infecting organisms and upon the interference with endobronchial drainage. As the density of the involved portions of the lung increases, the usual lung markings become obliterated, even the peribronchial radiations being lost in a shadow of uniform density (Case IV). Later, areas of decreased density may appear in this shadow of uniform density. These may be circular or irregular in outline, they may be single or multiple. It may also be noted that at the most dependent portion of these areas of decreased density the outline is horizontal, resembling a fluid level. Such areas can usually be interpreted as areas of destruction or cavitation, and in cases in which a horizontal line represents the most dependent portion of the rarefied area one is usually safe in interpreting such a finding as a fluid level (Cases V and VI).

Abscess cavities are rarely surrounded by recognizable capsules, but appear, rather, as defects within boundaries of uniform density which surround them (Case VI). Cavities which have attained a moderate size practically always communicate with a bronchus. The free access of air causes their fluid contents to assume a horizontal level, which is surmounted by a hemispherical air space. Such a horizontal level, which can be caused to shift by a change of position, is so characteristic of an accumulation of fluid with air superimposed that it constitutes positive evidence of a cavity even when, as frequently happens, the walls of the latter are indistinct or invisible. Cavities vary in size from some which are barely distinguishable (Case VIII, Fig. 2) to others which occupy a whole lobe (Case VI). This entire picture, from the very slightest increase in density of the pulmonary shadows to the changes indicative of cavity formation with fluid, may be seen to develop during a matter of from one to two weeks.

At times the roentgenologist must vary his procedure in order to detect cavities which are located in unusual situations. In Case VII is illustrated an irregular cavity which lies within a diseased right lower lobe. It was necessary to resort to the oblique position in order to disclose this cavity at its best, as it was partially obscured by the heart in the dorsoventral position. The same difficulty was encountered to a lesser degree in another case of lower lobe abscess on the right side. Here again, the cavity was partly hidden by the right ventricle in such a way that the evidence of its presence was not detected and doubt arose as to the nature of the patient's illness (Case XII).

LOCATION OF THE ABSCESS

The exact localization of the abscess, which we owe in such full measure to the roentgen examination, has a practical bearing which transcends its value as a mere

method of diagnosis To the surgeon who contemplates the drainage of a cavity or the incision of a lobe, or to the endoscopist, the situation of the abscess will determine his method of approach, and for this purpose an accurate localization is essential Even with the roentgen examination, this is not always possible Especially on the right side, the overlapping of the three lobes in the middle third of the chest will render it difficult to assign an infiltration in this region to any one lobe or to the adjacent portions of all three lobes Here stereoscopic examination may be of service In Case VI, for example, it is impossible to deduce, from the plate alone, whether the abscess is situated in one or more lobes, at bronchoscopy it was found that drainage occurred by way of the middle and lower lobe bronchi In these cases, dependence must be placed on the location of the physical signs and bronchoscopic findings to distinguish between an affection of the lower part of the upper lobe and upper part of the lower lobe, the shadows of which will be superimposed on the plate The findings at endoscopic examination are most dependable The endoscopist is able to identify the bronchus from which the drainage takes place, thereby determining the portion of the lung involved, unless the process has involved one lobe of lung and ruptured through an interlobar fissure to establish drainage through the bronchus of an adjacent lobe Some would hesitate to make a diagnosis of lung abscess during that stage when the first area of increased density appears (Cases II and III), preferring to await the time when an area of destruction has developed and a definite fluid level has presented itself, as in Case VI

Experience has shown us that a fluid level may not reveal itself when frank abscess formation has taken place Frequently, cavities which are full of secretion, especially when they are small, may be entirely obscured by the increased density of the lung about them (Case VIII) Then, too, lique-

faction can take place without the presence of sufficient gas or air to denote a fluid line The presence of a fluid level in an area of increased density in a lung field usually indicates the presence of a communication between the space containing the fluid and the tracheobronchial tree We have seen cases which failed to show such a fluid level, present a fluid level immediately after the institution of endobronchial drainage (Case IX) Certainly the abscess was present previous to the drainage and the diagnosis would have been of greater value could the development of the cavity have been anticipated and the diagnosis of an impending abscess have been made We are cognizant of the fact that the roentgenologist would require certain clinical information before making such a diagnosis, but we know of no reason why he should not be permitted to profit by all available information in the hands of the clinician in arriving at a conclusion

It is obvious that the radiologist will be aided materially in his diagnosis of impending abscess if he makes frequent roentgen-ray examinations, even daily, during the period of study It is not sufficient, however, to merely make X-ray plates and send the patient back to his room—a fluoroscopic study should also be made Frequently one finds that areas of altered lung markings can be brought out more satisfactorily in the X-ray plates, if at first the proper angle is selected during a fluoroscopic examination In addition, the mobility of the various contents of the thoracic cage can best be studied by fluoroscopy

DIFFERENTIAL DIAGNOSIS

Lobar Pneumonia—In the acute stage of a developing lung abscess the consolidation may develop in the hilum region, as in lobar pneumonia A second plate at the end of twenty-four hours or even a third after forty-eight hours should serve to differen-

sillectomie it is possible to definitely establish the date of the onset. Should one follow such a complication through all of its phases one would be able to obtain certain evidence of value.

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LOCATION OF THE ABSCESS

The exact localization of the abscess, which we owe in such full measure to the roentgen examination, has a practical bearing which transcends its value as a mere

for comparison of the condition at varying stages in the healing process. Only too often it happens that the physical signs may entirely disappear, temperature and sputum may disappear, and the patient may feel so well that a remaining focus will not be suspected. Roentgenographic studies may disclose a focus, and, so long as such a focus remains, it is a potential source of danger for further inoculation and spread of the disease. Cases VI, XVII, and XVIII illustrate instances which have been followed with X-ray studies. All these patients are now well.

We have always maintained that the one principle which must be strictly adhered to in the treatment of lung abscess regardless of the method used to obtain drainage, is that of efficient drainage. Needless to say, the more conservative the measures used the more desirable they become, provided the method is efficient. Physical signs and clinical observations serve to give some indication as to the efficiency of the drainage established, but it remains for roentgenographic examinations to pronounce the final word as to the efficiency of the method used and as to the desirability of discontinuing treatment. The roentgen studies enable one to correct defects in the posture selected for postural drainage. Bronchoscopic dilatations and aspirations can be carried out more efficiently if frequent roentgen studies are made to determine the rate of disappearance of the fluid level and pneumonitis and the closure of abscess cavities.

While it is true that a certain percentage of lung abscesses will heal without treatment other than postural drainage, it is too often the case that an abscess is permitted to go without other treatment until its walls have become indurated and much time has been lost. Many such abscesses require open surgical drainage (Cases XVIII and XIX), with its accompanying high rates of mortality and deformity. We have noted however, that a much smaller number of lung

abscesses require open drainage when they are followed closely by roentgen-ray studies at the same time that postural drainage and bronchoscopic drainage are being used. In fact, by combining posture and bronchoscopic drainage with careful roentgen-ray studies a very large percentage of lung abscesses can be cured without resorting to more radical measures. In making these suggestions we are not overlooking the fact that approximately 50 per cent of acute lung abscesses heal without any form of treatment. We feel, however, that the important thing is for us to strive to raise our percentage of healed abscesses from 50 per cent to as near 100 per cent as possible, without the aid of radical measures, if possible, and endoscopy in our experience has proven to be the most valuable aid at our command. We are better enabled to avoid the chronic lung abscesses which require months to heal by applying endoscopic methods of drainage as soon as we are able to make a diagnosis of impending lung abscess.

We realize that in many quarters the roentgenologist is expected to merely make a diagnosis from his X-ray films, in many instances without the aid of clinical evidence. From a considerable experience in the treatment of suppurative lesions of the lung, we have arrived at the point where we expect our roentgenologist not only to make a diagnosis, but we feel that he must go further, inasmuch as in many instances he will see the case earlier than the thoracic surgeon—we feel that he should make suggestions as to the probable necessity of intervention. He should call to the attention of the referring physician such findings as suggest the need of endoscopy early, so as to enable the patient to avoid the more severe complications and the more drastic measures that might be required at a later date.

The medical treatment of acute pulmonary suppuration is expectant and in reality no specific drug can be recommended. In the

trite the lesion mustache the consolidation in lobar pneumonia is usually much more rapid in its development than in the lung abscess.

Messier's Localized Pneumonia - The differentiation of an acute lung abscess from a massive pneumonia or a localized pneumonitis may be somewhat difficult. However, in the classical picture of massive, telestasic the characteristic findings (Case X) of a narrow hemithorax with an increased density of the involved portion of the lung and the narrow interspace, with the displacement of the mediastinal contents i.e. heart and trachea toward the involved side, and the elevation of the diaphragm serve as differential points to contrast with those previously described in the case of a lung abscess. In case of a localized pneumonitis the classical roentgen-ray findings may not all be present. If however the roentgen studies have been made shortly after the onset of the pneumonitis, there is always some evidence of fixation, elevation of the diaphragm or of contraction of the interspaces, with some displacement of the mediastinum. These findings may at times be seen at their best under the fluoroscope. It must be borne in mind that many post-operative lung abscesses develop in areas that were in the beginning merely areas of telestasis, and that relief from the bronchial obstruction in many instances prevents abscess formation.

Empyemas are also at times confused with acute lung abscesses. If however, the empyema is located adjacent to the mediastinum, there will be displacement of the mediastinal contents toward the good side (Cases XI and XII), in contrast to no displacement of these structures as in lung abscess. If the abscess is located in the peripheral portion of the lung or there is an intra-lobar empyema on the right especially the free use of the fluoroscope with the patient turned so as to bring the diseased area into view from all angles will be of aid. It may not be possible to make a fixed differential

diagnosis by means of the X-ray alone (Case XIII).

Chronic lung abscess cannot be entirely differentiated from chronic tuberculosis with cavity, by X-ray examination alone (Compare Case VII and Case XIV.)

A carcinoma of the lung may become secondarily infected and an acute abscess may develop in spite of having been made previous to the development of the abscess. Comparison may render the differential diagnosis much easier.

A chronic lung abscess can be differentiated from chronic bronchiectasia by X-ray studies such studies being rendered more valuable by the use of lipiodol as a contrast medium. In certain instances a lung abscess which fails to be revealed by the ordinary plates can best be shown by the use of lipiodol injected through a bronchoscope (See Cases VII and XV.)

Lung abscesses secondary to a foreign body, even those foreign bodies of metallic nature, are overlooked at times because of the failure of the physician to make use of the X-ray or because of improper roentgen-ray technic, when, on the other hand, a properly taken X-ray plate would point the way to the proper diagnosis and treatment of the case (Case XVI).

ROENTGENOLOGICAL AID IN TREATMENT

The part played by roentgenography in the treatment of lung abscess does not end with the diagnosis. Since the position and character of an abscess is a factor in determining the type of treatment to be instituted, the roentgen evidence becomes of utmost importance as a check on the efficacy of whatever line of treatment is instituted. It is a well known fact that a certain percentage of lung abscesses will heal without undue delay, following rupture of the abscess, with evacuation of its contents through a bronchus. Roentgen-ray studies are the means of making permanent records



Fig. 3 Case II

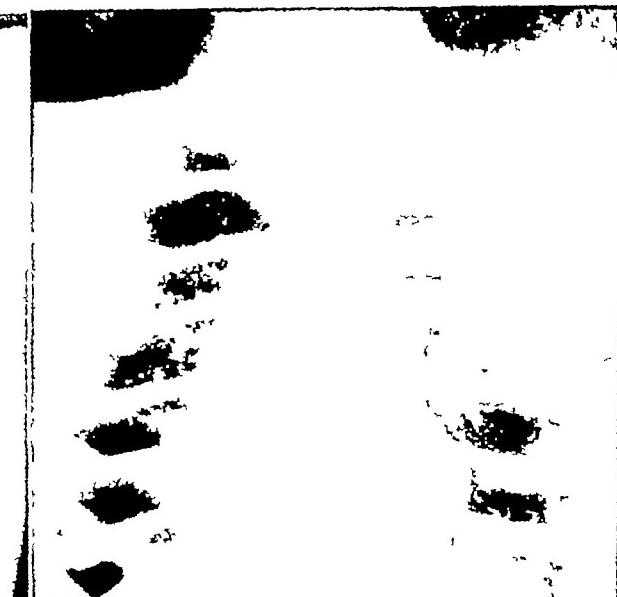


Fig. 4 Case II

CASE REPORTS

Case I—This patient was a white male about 45 years of age, who gave a history of having had all of his teeth extracted under gas anesthesia one week previous to his admission to the hospital. At that time he was very ill, and was coughing up large amounts of very foul sputum which contained many organisms, including the fusospirochetal organisms of Vincent. X-ray studies revealed extensive areas of increased density throughout the right lung field and at postmortem it was found that the right lower and middle lobes were fused across the interlobar fissure by a plastic exudate (Fig. 1), and on section (Fig. 2) it was noted that there was extensive excavation extending directly across the region of the interlobar fissure.

Case II—This patient is a white male 20 years of age, who had had some teeth extracted ten days previous to this X-ray examination (Fig. 3). Within the first week after the extraction he developed a non-productive cough and a low grade temperature, with marked malaise. The X-ray stud-

ies show an area of increased density in the medial portion of the right lower lobe, with radiating lines extending toward the periphery. The diagnosis was obstruction to a division of the right lower lobe bronchus. Bronchoscopy was done and a plug was removed from a medio-posterior division of the right lower lobe bronchus. Microscopic



Fig. 5 Case III



Fig 1 Case I



Fig 2 Case I

adoption of expectant treatment and the attempt to evacuate the cavity by way of the bronchi without resort to more active measures, it is to be appreciated that there is the risk of extension of the suppurative process into nearby or remote parts of the lung, the development of a complicating pneumonia, empyema, cerebral abscess, or septicemia, and that in consequence of delay the local or general condition may become less rather than more favorable for the application of other methods of treatment.

It is not an everyday occurrence for the general practitioner to encounter a lung abscess and one must not censure him too severely if he does not resort to endoscopy or some conservative method of active treatment at an early date. On the other hand, the roentgenologist will see numerous cases, and if he has acquainted himself with the progress of other cases that have passed through his hands, he can with all sincerity advise intervention or at least consultation as to the advisability of intervening.

The fact that some cavities heal spontaneously is not sufficient to warrant any man

following a program of watchful waiting. The calamities will so far outweigh the successes that one can no more find justification for such delay than one could find justification for such a course in the average case of acute appendicitis.

One might summarize these experiences in the following manner:

(1) The roentgenologist is an important and necessary link in the personnel handling lung abscesses; he should make use of all clinical information available in arriving at his diagnosis.

(2) The roentgenologist should do more than arrive at a diagnosis; he should make suggestions in regard to probable need of treatment.

(3) The roentgenologist should follow his cases to learn the ultimate results.

(4) It is desirable to make a diagnosis of impending lung abscess rather than to wait for a full-blown abscess to develop before making a diagnosis.

(5) In our experience, conservative active methods of treating lung abscess have been the most satisfactory.



Fig 9 Case V



Fig 10 Case V

ray studies (Fig 7) reveal an area of markedly increased density in the region of the right middle lobe and the lower portion of the upper lobe. The lateral view (Fig 8) reveals a similar density in the region of the middle lobe. Open drainage was performed and an extensive lung abscess opened up which involved the lower half of the right upper, the entire right middle, and the upper part of the right lower lobe. Cultures revealed a staphylococcus. The patient, now at the end of six years, remains in good health.

Case V—This patient is a white female 24 years of age, with a history of a tonsillectomy under ether anesthesia two weeks before the present examination. Following the tonsillectomy she developed a cough, non-productive at first, but becoming productive of foul sputum and accompanied by temperature, loss of appetite, together with general malaise. There was severe pain over the right lower chest posterolaterally. X-ray

examination (Fig 9) reveals an area of increased density in the lower medial portion of the right lower lobe, together with a punched-out area of decreased density which has a straight line for its most dependent border. It is to be noted that there is no definite wall or capsule about this area of decreased density, which simply occurs in the middle of an area of otherwise equal density. Attention should be directed, also, to the deformity of the spine. Diagnosis of lung abscess was made. Bronchoscopic aspirations were done and in the follow-up plate (Fig 10) it is to be noted that the area of increased density, at the right base, has entirely disappeared and that there no longer remains any evidence of the punched-out area seen in the first studies. Instead, there appear, now, normal lung markings. Meanwhile the patient's physical signs, temperature and cough, have entirely disappeared.

It is to be noted that the clinical course in the case of this patient was prolonged over

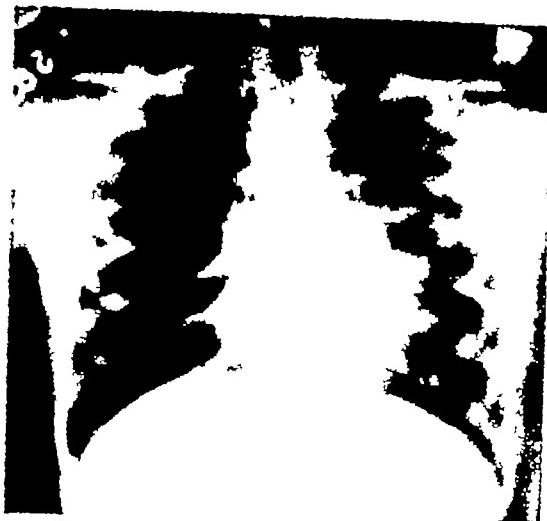


Fig. 6—Case III.

cough. It was noted that in the X-ray film there was seen an area of increased density in the medial portion of the right lower lobe, adjacent to and confluent with the heart shadow. Temperature at this time was 105°



Fig. 8—Case IV.

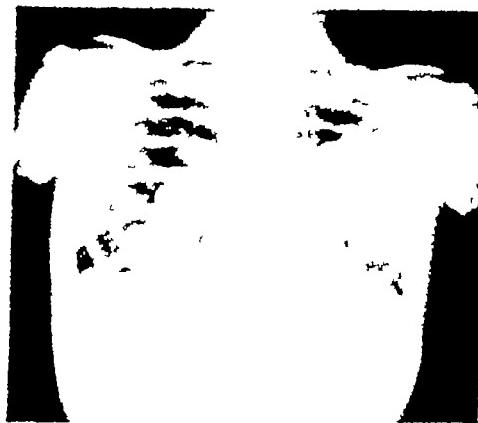


Fig. 7—Case IV.

examination proved this to be a piece of peridental membrane. Cultures revealed virulent long chain streptococcus. A second film, made within forty-eight hours after bronchoscopic removal of the plug, reveals a disappearing shadow (Fig. 4). At the same time the patient's temperature and cough have entirely subsided.

Case III.—This patient is a white female 8 years of age who entered the hospital with a history of tonsillectomy under ether anesthesia eight days previously and five days previous to X-ray examination (Fig. 5). Following the tonsillectomy there developed malaise, temperature and a non-productive

A diagnosis of an impending lung abscess due to bronchial plug was made. Bronchoscopy was done. A plug of mucus and old blood was removed from the right lower lobe bronchus. A virulent short chain streptococcus was obtained on culture. Immediately, the condition improved, the temperature reached normal within twelve hours, and did not rise again above 99° . The X-ray film (Fig. 6) at the end of twenty-four hours reveals a clearing of the area of increased density, with the reappearance of the right heart shadow.

Case II.—This patient is a white male 7 years of age who underwent the operation of tonsillectomy four months previous to the present illness. Ether anesthesia was used and the anesthetic was said to have been administered with difficulty. Within two weeks after the tonsillectomy the patient developed a cough (non-productive), malaise and a temperature which ranged from 99° to 103° . He lost a great deal of weight. X-



Fig 9 Case V



Fig 10 Case V

ray studies (Fig 7) reveal an area of markedly increased density in the region of the right middle lobe and the lower portion of the upper lobe. The lateral view (Fig 8) reveals a similar density in the region of the middle lobe. Open drainage was performed and an extensive lung abscess opened up which involved the lower half of the right upper, the entire right middle, and the upper part of the right lower lobe. Cultures revealed a staphylococcus. The patient, now at the end of six years, remains in good health.

Case V.—This patient is a white female 24 years of age, with a history of a tonsillectomy under ether anesthesia two weeks before the present examination. Following the tonsillectomy she developed a cough, non-productive at first, but becoming productive of foul sputum and accompanied by temperature, loss of appetite, together with general malaise. There was severe pain over the right lower chest posterolaterally. X-ray

examination (Fig 9) reveals an area of increased density in the lower medial portion of the right lower lobe, together with a punched-out area of decreased density which has a straight line for its most dependent border. It is to be noted that there is no definite wall or capsule about this area of decreased density, which simply occurs in the middle of an area of otherwise equal density. Attention should be directed, also, to the deformity of the spine. Diagnosis of lung abscess was made. Bronchoscopic aspirations were done and in the follow-up plate (Fig 10) it is to be noted that the area of increased density, at the right base, has entirely disappeared and that there no longer remains any evidence of the punched-out area seen in the first studies. Instead, there appear, now, normal lung markings. Meanwhile the patient's physical signs, temperature and cough, have entirely disappeared.

It is to be noted that the clinical course in the case of this patient was prolonged over

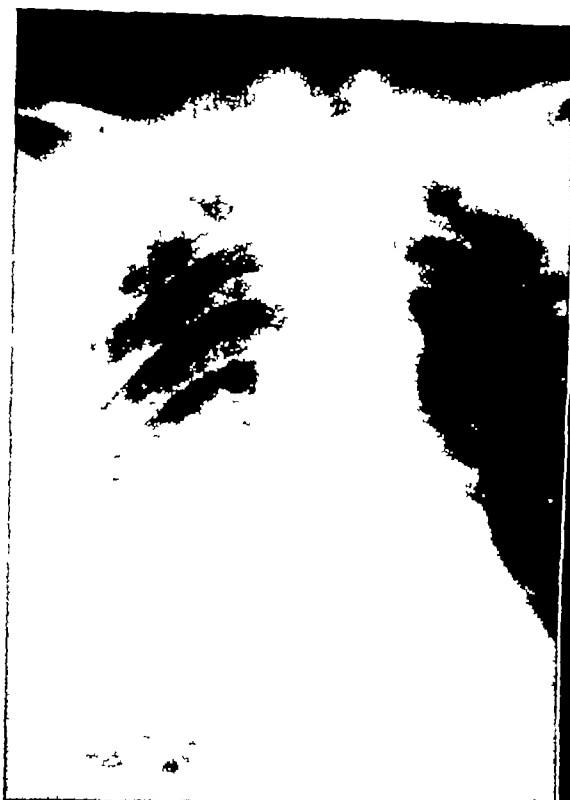


Fig 11 Case VI



Fig 12 Case VI

that of Cases II and III, the latter two requiring only one bronchoscopic drainage each, while this patient required drainages three times a week for the first three weeks in order to maintain continuous drainage.

Case VI—This patient is a white male 27 years of age. There is a history of an indefinite onset of a "flu" or grippelike character with the gradual appearance of productive cough. X-ray studies (Fig 11) reveal an area of increased density in the region of the right lower and middle lobes of the lung. There is shown in this area of otherwise uniform density an irregularly punched-out area of decreased density, and in an X-ray film (Fig 11) taken in the posteroanterior position, the patient in the upright position, there is a horizontal line at the most dependent portion of the punched-out area. With the patient lying on his left side (Fig 12) there is a shifting of this line so

that it lies parallel with the spine. With the patient in the upright position, in the lateral view (Fig 13), again an irregular punched-out area of decreased density appears, which occupies a considerable portion of the chest at this point, and the horizontal line is seen in a new position. A diagnosis of extensive lung abscess was made. Repeated bronchoscopic drainages were carried out, with entirely satisfactory results.

Figure 14 shows the scar that remains at the end of three months, as seen in a posteroanterior film, while Figure 15 shows the same in a lateral view. The enormous size of this cavity, and the prolonged and energetic treatment that was necessary, as compared with the story told by Figures 12 and 13 merely serve to emphasize the importance of an early diagnosis with early treatment in a developing suppurating lesion.

Case VII—This patient is a white male



Fig 13 Case VI

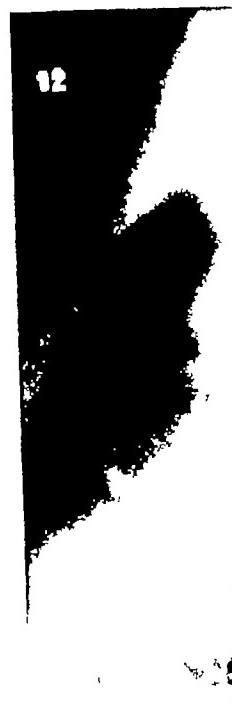


Fig 15 Case VI



Fig 14 Case VI

47 years of age, who gives a history of repeated pulmonary hemorrhages at frequent intervals over a period of twenty years. Repeated X-ray examinations have failed to reveal anything of diagnostic importance. Physical examinations revealed nothing definite in the chest. Bronchoscopy was done

and a small cavity was identified at the root of the right lung, off from the first portion of the lower lobe bronchus. This cavity was filled with lipiodol and plates made in the postero-anterior position (Fig 16) and in the oblique position (Fig 17). Diagnosis: Chronic lung abscess, right lower lobe, probably due to rupture of a suppurating lymph gland.

Case VIII—This patient is a white female about 35 years of age with a history of a cough which developed following an illness of grippelike character eight weeks previous to the present examination. Associated with the cough are malaise and a temperature up to 103° . X-ray studies in the postero-anterior position (Fig 18) reveal an area of uniformly increased density in the left upper lobe. Because of the location of this lesion pulmonary tuberculosis

was considered, but repeated sputum examinations were negative for acid-fast organisms. A diagnosis of impending lung abscess was made and bronchoscopy performed. X-ray plates taken in the same

former lesion, and the patient has remained well since.

Case IX—This patient is a white female 32 years of age who entered the hospital with a history of a cough, which developed



Fig. 16 Case VII



Fig. 17 Case VII

position (Fig. 19) following bronchoscopy show a definite decrease in the extent of the area of increased density and also reveal a punched-out area of decreased density. A third X-ray film (Fig. 20) within six weeks reveals disappearance of all evidence of the

following delivery under gas anesthesia two weeks previously. X-ray films taken in the postero-anterior position (Fig. 21) at the end of twelve days reveal an area of in-



Fig. 18 Case VIII (Damaged film)



Fig. 19 Case VIII

creased density in the lower medial portion of the right lung field. Extending off from this area of increased density are numerous fine radiating lines of similar density. A diagnosis of impending lung abscess was made. Bronchoscopy was done and an inflammatory obstruction in the right lower lobe bronchus was relieved. Cultures from the secretion revealed a streptococcus. X-ray studies (Fig. 22) now reveal an area of decreased density within the area of uniform density.

This case serves to illustrate the fact that actual destruction of lung tissue may take place without the appearance of a fluid level within the area of destruction. When drainage is established, evidence of such destruction may be had. We would repeat the importance of making, in cases in which it is possible, a diagnosis of impending lung abscess.

Case X—This patient is a white male 42 years of age who underwent an appendectomy under spinal anesthesia thirty-six hours previous to the X-ray study shown in Figure 23. Within eight hours after the operation he showed an increase in his pulse rate and within ten hours there was an increase in the temperature and respiratory

rate. Physical findings revealed a cyanotic patient with evidence of consolidation throughout the right lung field. X-ray studies revealed the characteristic findings of a massive atelectasis of the lung. Bronchos-

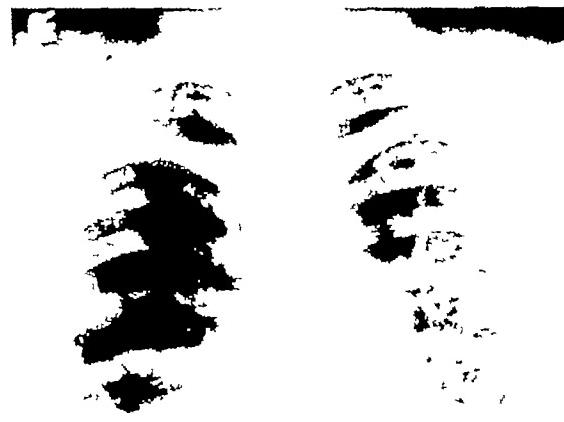


Fig. 20 Case VIII

copy was done, with immediate relief. X-ray studies taken immediately showed the clearing up of the markedly increased density in the right half of the chest, with a shifting of the heart toward its normal position.

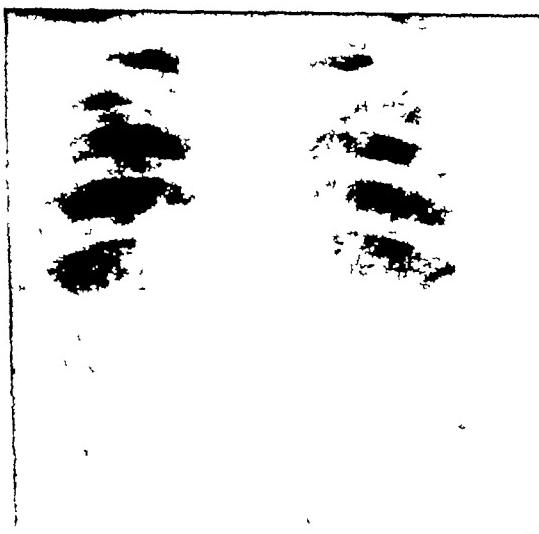


Fig. 21 Case IX.



Fig. 22 Case IX.



Fig. 23 Case X



Fig. 24 Case X

Case XI—This patient was a colored male 35 years of age, who gave a history of an illness characteristic of lobar pneumonia. After an interval of improvement there was again an increase in the symptoms, especially temperature and cough, with a small amount of sputum (without odor). X-ray studies in the postero-anterior position reveal an area of increased density

in the region of the left base near the midline, extending latterward to the chest wall with some displacement of the heart toward the right side. There is another shadow near the lateral chest wall behind the clavicle (Fig. 25). The diagnosis of lung abscess was considered in this case, but because of the displacement of the heart toward the right it was thought best to do a thoracentesis. This operation was done in the eighth interspace, about a finger's breadth lateral to the spine, resulting in the diagnosis of an encapsulated empyema. Thoracotomy gave further proof by the finding of such an encapsulation.

Case XII—This patient was a white male

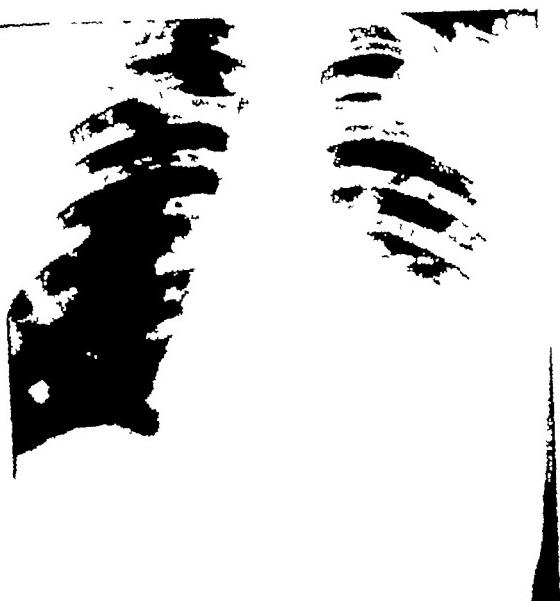


Fig 25 Case XI

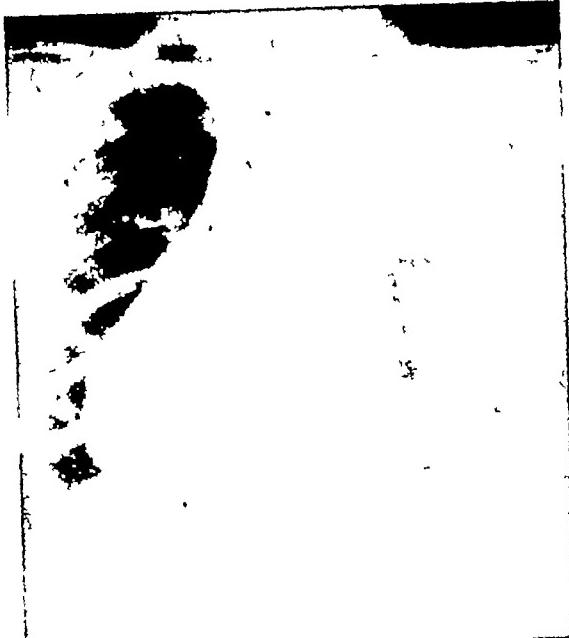


Fig 27 Case XII

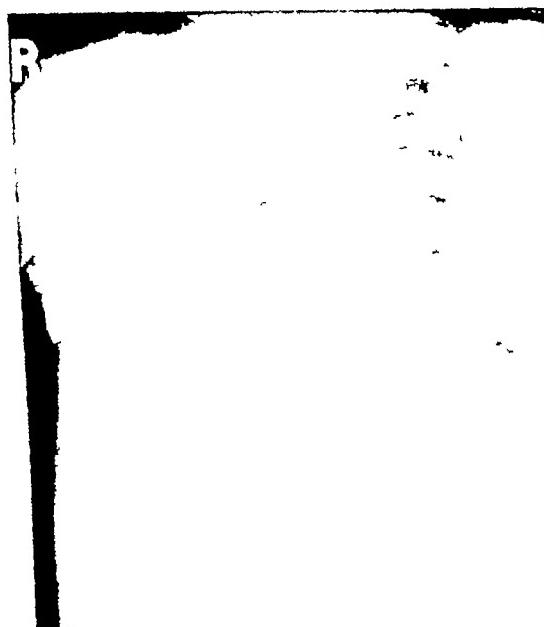


Fig 26 Case XII



Fig 28 Case XII

ray. The density is greater near the midline at the base and extends to the lateral chest wall, particularly at the level of the clavicle. As to diagnosis, a massive atelectasis following pneumonia was considered, also that of an unresolved pneumonia. However, because of the peculiar distribution of the

shadow, and the irregularity of the density in the lateral portion of the chest, a thoracentesis was done in the seventh interspace posteriorly about a finger's breadth lateral to the spine. Pus was obtained. Thoracotomy was performed, with satisfactory results. A follow-up film (Fig 27) reveals the persistence of the shadow in the upper

lung field. A thoracentesis was done through the third interspace in the axillary line and this revealed a second encapsulated empyema, which was treated by thoracotomy. The third study (Fig. 28) on this patient shows



Fig. 29 Case XIII



Fig. 31 Case XV



Fig. 30 Case XIV



Fig. 32 Case XV

the entire disappearance of the area of increased density in the right lung field following drainage of the encapsulated empyemas.

These two cases will serve to illustrate the importance of considering encapsulated empyemas in association with studies of suspected lung abscess.

Case XIII.—This patient was a white male about 18 years of age, who had a se-

vere case of diabetes. He entered the hospital with a history of an illness similar to a pneumonia, but at the end of several weeks he was expectorating large quantities of purulent material and was running a temperature. Physical examination still re-



Fig 33 Case XV



Fig 34 Case XVI

vealed a dull to flat percussion note over the right chest posteriorly. Following a first X-ray examination a thoracentesis was performed and pus obtained from the pleural space posteriorly. Thoracotomy was then performed and a second X-ray study was made (Fig 29). Note the thoracotomy tube in place. The findings that are of greatest interest, however, are as follows:

(1) An area of increased density along the right border of the mediastinum near the upper portion of which, near the level of the second rib anteriorly, one sees an area of decreased density with a horizontal line for its lower boundary.

(2) There is a second area of increased density near the level of the third rib anteriorly in the mid-clavicular line, right. The upper border of this area of increased density is also a horizontal line above which there is an irregular circular area without lung markings.

One is forced to consider the possibility of either or both of these areas representing a lung abscess. However, a thoracentesis

performed near the right border of the sternum revealed pus. A thoracotomy was then performed and it was found that the medial shadows were due to an encapsulated empyema between the right lung and the mediastinum. This had been draining by way of the interlobar fissure to the area represented by the second shadow, thence through a bronchial fistula. The single thoracotomy drained both areas. The patient made a complete recovery. The final diagnosis in this case was empyemas, encapsulated, there being three separate pockets.

Case XIV—This patient was a white male about 40 years of age who complained of a productive cough, some loss of weight, and of feeling tired. His complaints had gradually grown upon him. He did remember of having had a severe cold about four months previously. Physical examination revealed a temperature of 101° , and there was an area in the right lung field over which cavernous breath sounds were heard. X-ray study (Fig 30) revealed an area behind the third rib anteriorly on the right, which was interpreted as a cavity. The

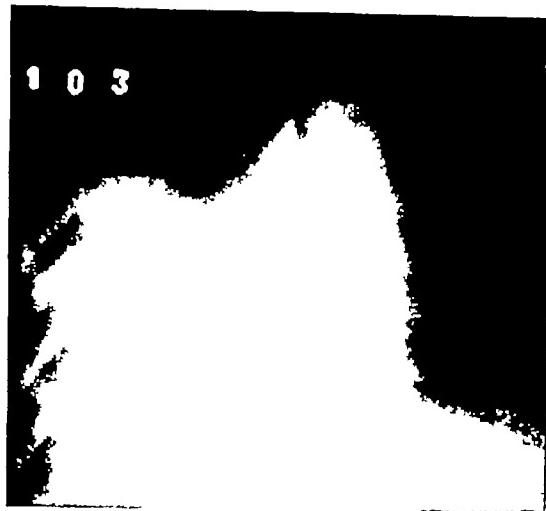


Fig. 35 Case XVI

location was such that the roentgenologist could not say whether we were dealing with an old tuberculous infection, with cavity formation, or with a non-tuberculous cavity. Sputum examination revealed tubercle bacilli. The patient was treated for tuberculosis and progressed nicely.



Fig. 36 Case XVI

Case XV—This patient was a white male 28 years of age who had been troubled with a cough ever since he could remember. He



Fig. 37 Case XVII



Fig. 38 Case XVII

expectorated a very large amount of purulent material. There were no other symptoms and his physical examination was entirely normal except for an occasional râle at the base near the midline on the right side. X-ray studies had failed repeatedly to show anything that could be interpreted as being definitely abnormal (See Figs 31 and 32). A bronchoscopy was then done and it was found that the orifice of the secondary bronchus from the lower lobe bronchus was inflamed and fixed. A tube was insinuated into the bronchus and it was aspirated, a considerable amount of purulent material being removed. Lipiodol (30 c.c.) was then allowed to flow into this area through the aspirating tube and the X-ray study was repeated (Fig 33). This revealed an area of considerable extent adjacent to and confluent with the right heart shadow which undoubtedly represented a cavity. Diagnosis Lung abscess.

This lesion was probably begun as a pleural process which ruptured through the lung to drain by way of the bronchial tree.

Case XVI—This patient was a white male 12 years of age, who gave a history of having developed a cough at the age of 4 years. He was treated at that time for whooping cough, but the cough never disappeared in spite of many previous examinations and much treatment. At the time these studies were made, the patient was very ill, with a distressful cough, purulent sputum, and a temperature of 103°. There were physical signs of a consolidation over the entire right lower half of the chest. X-ray study (Fig 34), using the regular technic for lung detail, revealed a shadow of markedly increased density over the right lower half of the chest. Inasmuch as this patient had been repeatedly examined in attempts to determine the source of his disturbance, it is felt that something more than a routine X-ray examination was necessary. Fluoroscopic studies were also made, paying particular attention to that portion of the



Fig 39 Case XVII

lung involved in the area of markedly increased density. It was noted that there was one point of density which seemed to differ from the other points of increased density. Accordingly, other X-ray studies (Figs 35 and 36) were made, using technic more suitable for bringing out bone detail. It is to be noted that there is revealed a shadow which resembles a wood screw, and that there is some irregularity in the outline of this shadow, which one might take to represent a deposit of rust or similar material about a screw. Lateral films reveal what might be threads on a screw. Bronchoscopic removal of a screw, coated with rust, resulted in the disappearance of the cough and a clearing up of the right base.

These studies are shown to emphasize the importance of fluoroscopy as well as multiple X-ray plate studies and illustrate the ease with which even a metallic foreign body may be overlooked in the lungs.

Case XVII—This patient was a white male 62 years of age who entered the hospital complaining of an illness which had

had an indefinite onset—malaise with a non-productive cough and a temperature X-ray studies at that time (Fig 37) revealed a large area of uniformly increased density occupying the middle portion of the

with postural drainage, it is to be noted that evidence of the infection has largely disappeared. The patient has remained well since Diagnosis is lung abscess of unknown etiology.



Fig. 40 Case XVIII



Fig. 41 Case XVIII

right lung field. At one point there is noted an area of decreased density, the lower border of which is a horizontal line. Diagnosis of lung abscess or pulmonary tuberculosis with cavitation was made because of these findings. However, repeated sputum examinations were negative for tubercle bacilli. A bronchoscopy was done and pus was found to be draining from the middle lobe bronchus. An aspirating tube was inserted into this bronchus and the bronchus was thoroughly aspirated. X-ray studies were again made (Fig 38) and it is to be noted that the area of markedly increased density has cleared to a considerable extent. However, the area of decreased density appears very much larger in these studies and there still remains a horizontal line. After thirty days, during which interval several bronchoscopic aspirations were carried out, along

Case XVIII.—This patient was a white male about 38 years of age who gave a history of having had a tonsillectomy performed under ether anesthesia five months previously. Two weeks following his tonsillectomy there developed a non-productive cough, marked malaise, and a temperature. During the succeeding five months he had a number of hemorrhages, coughed up large amounts of foul sputum, and lost a great deal of weight. Diagnosis of lung abscess had previously been made. He had been treated by bed rest, postural drainage, and pneumothorax. In spite of these measures the patient's condition became worse and at the time these X-ray studies (Fig 40) were made the man was extremely ill. The studies show first evidence of the previous pneumothorax at the right base. There is also an area of increased density occupying

the region of the right lower and middle lobes. Associated with this is a large area of decreased density, the lower border of which is a horizontal line. Diagnosis of lung abscess was confirmed in the absence of tubercle bacilli in the sputum. The patient was operated on and open drainage of an enormous abscess, occupying the greater portion of the lower lobe of the right lung, was obtained. Recovery was without complications, leaving a bronchial fistula. X-ray studies at the end of one year (Fig. 41) show the deformity in the bony structure as well as the amount of scar tissue that remains. Lipiodol injected through the bronchial fistula, as a means of contrasting



Fig. 42 Case XVIII



Fig. 43 Case XIX



Fig. 44 Case XIX

the bronchial tree, demonstrates the amount or the portion of the right lower lobe that remains (Fig. 42).

This case illustrates the importance of making an early diagnosis when possible. It also illustrates the degree of destruction and deformity that may be encountered.

Case XIX—This patient was a white female 8 years of age who gave a history of having had a tonsillectomy done under

ether anesthesia three weeks previously. Within the first week following the tonsillectomy there developed a non-productive cough, a temperature, and general malaise. After ten days the cough became productive, temperature remained high, and the patient's condition continued to fail. X-ray studies (Figs. 43 and 44) at the time she was seen, revealed an area of increased density occupying a considerable portion of the right

lung field. Within this area of increased density there was an area of decreased density which might be interpreted as a cavity.



Fig. 45 Case XIX

The lateral view (Fig. 44) shows the depth of this area in the antero-posterior position

Tubercle bacilli were not found in the sputum. Accordingly, diagnosis of lung abscess, post-tonsillotomie, was made. Because of its extent it was felt advisable to do an open drainage. This was accomplished by resection of ribs in the mid-axillary line, with drainage of the cavity at this point. X-ray studies at the end of six weeks show the extent to which the lesion has cleared.

This case, contrasted with the cases in which early diagnoses have been made, serves to emphasize the importance of an early diagnosis. The patient made a complete recovery.

We wish to thank all those radiologists who have been so liberal of their time and efforts when handling cases with us. We wish especially to thank Dr. Rollin H. Stevens, Dr. Hans A. Jarre, and Dr. Clyde Hasley for their unlimited patience with us.

THE ROENTGEN RAY IN DIAGNOSIS AND PROGNOSIS OF UPPER URINARY TRACT INFECTION

By H W PLAGGEMEYER, M D, and C G WELTMAN, M D, DETROIT, MICHIGAN

SINCE Nitze's epoch-making discovery of the cystoscope in 1877, no other single factor has added so much to the advance of urology or contributed so much to its scientific exactness as has the roentgen ray. Nor, by the same token, is any other branch of medicine so dependent upon the X-ray as is present-day urology. Indeed, without it, the urologist is entirely bereft of that which makes his diagnosis so positive and so nearly correct, urography and pyeloscopy having been aptly described as the urologist's most valuable aid in diagnosis.

It is an interesting chapter in the history of medicine which records the endeavors of such men as Tuffier (1897), Fenwick (1905), von Lichtenberg (1906), Keyes (1909), Uhle and Pfahler (1910), and others, in their efforts to render the upper urinary tract opaque to the roentgen ray. Many methods were used and discarded because of certain untoward effects, until, at the present time, probably the most widely used method is that of injecting sodium iodide of from 12 to 30 per cent solution until the kidney pelvis is filled, as evidenced by pain or discomfort to the patient, and then making a pyelogram in both recumbent and upright postures, and, finally, partly withdrawing the ureteral catheter and filling the ureter, thus making another exposure which outlines both the pelvis and ureter. Some urologists use a large catheter to obstruct the lower ureter and inject the pyelographic medium until the entire tract is distended by backflow. That there is still a great difference of opinion as to what constitutes the proper procedure in performing urography is stressed by Hinman in his work on hydronephrosis when he says,

"Authorities differ as to the relative value of the different methods used in making ureteropyelograms."

In spite of the fact that X-ray has been used all these years to aid in making urologic diagnoses, the fact remains that, as it is generally used to-day by the majority of men, the X-ray does not give all the information which should be had from such a procedure or all that is essential to a complete understanding of the pathology of the upper urinary tract. Pyelography, while absolutely essential, as routinely done shows only the anatomical form or morphology of the urinary tract. Furthermore it is often necessary to repeat the examination because of some obscurity or baffling appearance. If the case is one of advanced pathology, then knowledge of gross anatomic change is probably all that is needed. But, in the great majority of cases, it is absolutely essential that a definite knowledge be had of the physiology or motor function as well as of the anatomic form in order properly to prognosticate and treat the case. Thus, to enable one to apply the correct therapy, a complete X-ray diagnosis must include a study of the physiology or motor activity of the pelvis as well as its morphology. Must one wait until there is gross tissue change before one can apply the proper treatment? What is therapeutics? According to Billings, "Therapeutics is largely an effort to convert pathologic into normal physiology. Intelligent therapeutics and pathologic physiology should go hand in hand." Thus, a knowledge of the form as well as the physiology of the pelvis and ureter can be obtained only by combining a motor functional study with pyelography.

The physiology of the pelvis and ureter is

analogous to that of the stomach and duodenum. They are both contractile organs endowed with a motor activity and a sphincteric function. The physiology of the pelvis is characterized by a succession of movements or contractions and relaxations, opening and closing of sphincters in a harmonious way and at a precise time. In nephrectomized kidneys preserved in saline, it has been observed that the kidneys contracted at times spontaneously but could be excited to contractions by mechanical stimulation either of the ureteral stump, pelvis, or calices. These excitations produced the following movements: the pelvis is first in diastole, or relaxed, extending beyond the renal sinus. By stimulating the stump of the ureter, the pelvis is caused to contract and withdraw itself up into the renal sinus, where it disappears, drawing the ureter after it. Presently one sees the pelvis slowly relax, little by little, and at the same time, a wave is produced in its inferior extremity and is propagated to the stump of the ureter, which executes a creeping movement. Then follows a sharp phase of inexcitability which continues for a variable period of time after each contraction.

Clinically, this phenomenon is beautifully demonstrated in the normal pelvis by injecting a pyelographic medium under fluoroscopic vision and, while the pelvis is filled (but not to the point of distention and production of pain), withdrawing the catheter and observing its contractions. One notes the following: besides the large respiratory movements, on close observation there is to be seen a wave of contraction progressing from calices to pelvis which carries with it part of the opaque liquid in the calices and causes them to appear more dense. This wave of contraction then spreads over the pelvis and forces some of the fluid into the bulb, that small portion between the pelvis above and ureter below, which has been closed until this time by the supra-bulbar sphincter. None flows into the ureter since

at this moment it is closed by the infra-bulbar sphincter. At the time of filling the bulb, the systole of the pelvis, coinciding with the diastole or relaxation of the calices, produces a refilling of the calices. Also at the end of this period a second wave, or the first one momentarily arrested, beginning in the bulb, forces open the infra-bulbar sphincter and continues rapidly down the ureter to the bladder. The bulb remains visible generally for from two to three seconds. The supra-bulbar sphincter prevents reflux into the pelvis as well as emptying of the pelvic contents into the ureter. This process continues until the pelvis is empty. Masses in the amount of 1/10 c.c. are forced periodically from the bulb into the ureter. These masses appear from 3 to 10 seconds apart and pass rapidly down the ureter, outlining its curves and contractures. The pelvis normally empties its 5 to 10 cm of injected material at the rate of approximately 1 c.c. per minute.

In studying the physiology of the pathologic pelvis, one notes abnormal fillings. Reflux around the catheter back into the ureter is abnormal if the tip of the catheter is well within the pelvis. This condition is often due to errors of technic, such as too rapid injection, or to the injection of too much liquid, resulting in acute pelvic spasm and production of severe pain in the patient. These errors immediately render further functional studies useless since they induce an abnormal physiology. This reflux is also seen where the sphincters are insufficient. In these cases, the opaque fluid runs down the ureter as the injection is in progress.

We next study abnormal modifications in evacuation, paying especial attention to the bulb, particularly noting its situation. It normally connects the inferior medial border of the pelvis with the ureter. It may be irregular and contorted due to peripelvic sclerosis, or one might see a notch or constriction running through it, caused by an

abnormal artery. This defect persists throughout the examination, but none of these deformities in themselves constitutes a disturbed motor function. Thus, in order to make a correct diagnosis, one must observe the entire picture and not an isolated finding, based on a single pyelographic plate. The bulb, as previously remarked, is formed normally every 3 to 8 seconds. If the evacuation be retarded, this rhythm is interfered with and the time between "bulbs" is prolonged. Yet, however retarded this rhythm may be, as a general rule the bulb empties itself promptly. Again, one at times sees a complete or incomplete loss of sphincteric power, in which case the liquid either flows or dribbles into the ureter more or less continuously. Here, however, one finds the evacuation retarded because of pelvic inactivity.

In considering abnormal modification of contractions of the pelvis, the degree of their intensity is of most importance. They may be either very active or completely abolished in a pelvis the walls of which are rigid and sclerosed. In discussing abnormal passage of the liquid through the ureter, Legueu says that in some cases stricture, kinks, calculi, etc., cause a mechanical stagnation and dilatation above the obstruction, but in most of these cases it will be impossible to pass a catheter by the obstruction. If the catheter passes and one succeeds in filling the pelvis, one sees after its withdrawal either a normal evacuation or pelvic retardation. If there is pelvic retention, it is not mechanical but reflex and one sees neither pelvic contractions nor bulb formations. Moreover, there is no accumulation of liquid between the kink or apparent obstruction and the pelvis. Finally one judges the time of pelvic evacuation by a study of the mode of formation of the bulb as well as the motility of pelvis and calices. The normal evacuation presupposes a harmonious equilibrium between two elements, the force which propels, i.e., the

contractions of the pelvic musculature, and the force which holds in check or rules over the intermittent discharge, i.e., the pyelo-ureteral sphincters. The pathologic modification of the play of these two forces which brings about different degrees of impaired motility in the upper urinary tract. These variant degrees of disturbed motor activity may be classified as incontinences and retentions.

1 Complete pelvic incontinence is rare and is seen only in cases in which the pelvis and ureters are sclerosed, as in advanced tumor formation, in some cases of primary infection, and in some congenital dilatations. The fluid runs out into the bladder immediately after the catheter is withdrawn. One sees neither pelvic contractions nor bulb formation. In this type of case, one could get good pyelograms by filling the bladder with fluid and producing backflow into ureter and pelvis.

2 Where there are insufficient sphincters, the fluid immediately on injection flows into the ureter almost continuously. No definite formation of bulbs is seen and the flow of liquid is only temporarily interrupted from time to time. The evacuation is, however, prolonged since the pelvic contractions are very feeble. This type is similar to chronic incomplete retention and is seen in a large number of pyelonephritic cases.

3 In a very rapid evacuation or hyperkinetic pelvis, contractions are very strong, the bulbs are rapidly formed, and the pelvis is emptied very quickly. These cases, which give a history of marked vagotonia with attacks of renal pain, are benefited by the use of belladonna. We have recently seen a case of this type respond to this treatment. This class is very closely allied to acute spasm.

4 Under the heading of chronic incomplete retention, one finds several degrees of retention slight retardation of evacuation characterized by slow formation of bulbs

and prolonged evacuation time, retarded evacuation with insufficient sphincters as mentioned previously, incomplete retention with residue where the evacuation starts out normally, but bulb formations become further and further apart and finally cease altogether, leaving a residue in the pelvis or calyx, Crabtree's intermittent retention seen in movable kidneys, where one finds stasis during renal ptosis but, on relieving the ptosis, contractions are established. This latter test is the only true indication for nephropexy.

5 In chronic complete retention, the liquid remains in the pelvis for many hours and is finally diluted by secreted urine.

6 Acute spasmodic retention, due to errors in technic when a small pelvis is forcibly over-distended, occurs repeatedly when pyelograms are made blindly, and the patient is caused much needless pain and suffering.

Study of the physiology of the pelvis and ureter has pointed out the fact that a dilated pelvis is the result of an impaired motor activity. It is not in itself a primary condition. If it is dilated to such an extent that a diagnosis of hydronephrosis can be made from a pyelogram, then it will certainly show a markedly impaired function. More than this, functional studies by fluoroscopy will show an impaired motor activity or retention long before dilatation can be determined. Dilatation or anatomical change is slow to progress and only secondary to retention, which is influenced reflexly and changed readily. Dilatation and retention both represent an alteration of the pyeloureteral muscle but atony or dilatation is a stable state which changes slowly, while the motor activity represents the actual state of muscular contraction at a given time. It is true that the more marked the distention, the more deficient the motor activity. That the impaired function is primary is seen in types accompanied by small hydronephrosis with little or no distention, but having at-

tacks of renal colic and a hyperkinetic pelvis, or in cases with incomplete retention. Here the deficient muscular activity produces retention which later leads to atonicity or dilatation. It is an established fact that the motor activity of the renal pelvis is very quickly influenced by reflex. This has been proved many times in cases of renal calculi, abnormal arteries, etc., in which the stasis rapidly clears up after removal of stone or section of an artery. From a prognostic view, let us point out the fact that a pelvis not dilated but having incomplete retention progresses slowly to dilatation and atonicity unless the cause of the retention is removed. On the other hand, a dilated pelvis which evacuates itself sufficiently is one in which the dilatation will improve as time goes on. To be of prognostic value, a functional study must show not only whether there be retention but also to what degree retention has progressed. Thus X-ray studies, to be complete, must show us the physiology as well as the gross anatomy of the pelvis. Ureteral catheterization demonstrates the bacteriology. Infection and distention of the pelvis do not progress equally. In fact, infection may mitigate against distention by producing sclerosis of the pelvic walls, however, the degree of infection and retardation in evacuation of the pelvis go hand in hand.

It is admitted by all that stasis is the prime factor in the perpetuation of the great majority of kidney infections. It is the bugbear of urologists. The treatment of kidney infection is, therefore, largely the correction of those conditions which cause stasis. Pyeloscopy not only shows the degree of stagnation, which is of prognostic value, but points out the causative factor, be it stone, kink, excessive mobility of the kidney, stricture of the ureter or other cause. After this causative factor is removed, the motor function soon returns to normal and then the infection responds readily. Bear in mind that this deranged motor activity is

often reflex and the pyelographic plate will show a pelvis practically normal in size and contour, but the fluoroscope will point out the fact that it is not functioning properly Pelvic lavage will never clear up a pyelonephritis unless the motor activity of the pelvis is normal When normal physiology is established, even gross pathologic anatomy will in time return to an almost normal condition, if too much permanent damage to the kidney parenchyma has not been done

From a therapeutic viewpoint, pathologic pelvis may be placed in two classes

1 *Primarily Aseptic*—Motor functional impairment is primary yet trophic disturbance or dilatation progresses along with it If infection is added to this weakened organ, pyonephrosis readily follows In this type, which includes the great majority of chronic pyelonephritic cases, the cause of the retention must first be discovered and removed, following which the infection is readily overcome

2 *Primarily Infected*—Here the normal pelvis is infected and, instead of large dilatations, one sees sclerosis, which likewise brings about disturbed function The two thus work in a vicious circle If the retention is complete in this type of pelvis, one had best do a nephrotomy and put the pelvis at rest If it is impaired to a relatively slight degree, lavage may bring about cure

CONCLUSION

May we emphasize the fact that fluoroscopy is essential in making an X-ray study of the kidney, for by it we—

1 Fill the pelvis sufficiently but never over-fill, thereby causing the patient severe pain

2 Clear up obscurities by noting them during the examination, when they can be studied, and not later when pyelograms are being viewed Under vision the kidney may be palpated, thus its mobility, relation to stone, foreign bodies, tumor, etc., may be noted

3 Take pyelograms or permanent records of observed stages of pelvic activity and do not work blindly as in the past

4 Learn what pyelography alone can not show us, that is, determine the physiology of the pelvis at the time of examination and point out the causative factor if its motor activity is impaired By so doing, we render the examination truly scientific and save our patient much pain and suffering and, indeed, even prevent the possible loss of the kidney itself It is not a difficult feat to remove a destroyed pyonephrotic kidney but how much better it is to correct disturbed function in its incipiency and to prevent destruction of the kidney This then must be the service the roentgen laboratory can render the urologist in the future

FRACTURES AND INCOMPLETE DISLOCATIONS OF THE MANDIBLE OR MAXILLA

By LLOYD ROGERS, D.D.S., C TAYLOR HALL, D.D.S., and
JOHN H SHACKELFORD, D.D.S., DETROIT, MICHIGAN

LET us say at the outset that it is not our intention to impose our methods upon others. Our only intention, indeed, is to attempt to give some practical instruction on the subject of fractures—a subject which has, in the last few years, been one of increasing importance to the dental, as well as to the medical, profession.

While our method of treating fractures is neither new nor complicated, the results obtained have been highly gratifying. And we believe we may be pardoned the assumption that if results are satisfactory, the methods employed must be worth some consideration.

FRACTURES

During the past sixteen years we have seen and treated a large number of fractured jaws. In 1928 our clinic extended services to 312 patients, in 1929 this number was increased to 376 patients, and in

1930 to 482. Of this number, 94 per cent were treated for fractures of the mandible, the remainder for fractures of the maxilla.

Detroit, curiously enough, seems to have earned a reputation for skull and jaw fractures. This phenomenon may be partly attributed to the fact that, being the motor center of the world, rapid transportation here is on a steady increase, bringing in its wake an inevitable and concomitant increase in accidents. As a matter of fact, Detroit has more automobile accidents, *per capita*, than any other city in America, and automobile accidents appear to be the chief contributing cause of fractures.

Next to vehicular accidents, John Barleycorn must come in for a substantial share of the blame. Intoxication leads frequently to fights, and fights to broken jaws. Add to these the occasional meetings of skull and black-jack, falls, gunshot wounds, and numerous other accidents which occur readily



Fig. 1 Gunshot fracture of mandible and maxilla.

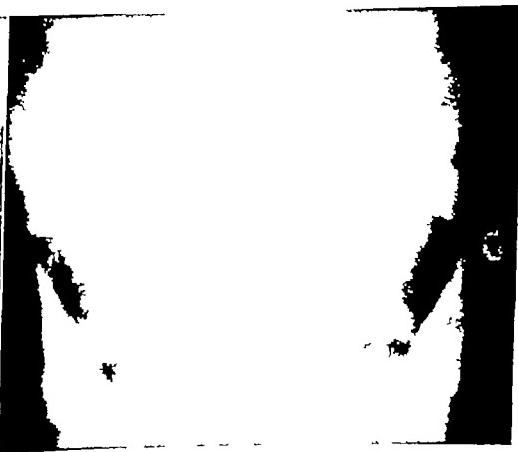


Fig. 2. Head of condyle destroyed by gunshot.



Fig 3 Gun slug fracture of mandible, with large facial wound



Fig 4 Fracture of mandible, showing the usual condition from non-treatment or no immobilization

in a large city, and it is easy to see how the number of fractures grows

It has been our observation that many fractures of the jaws are overlooked. For example, a patient is taken to a hospital from the scene of an accident. He is probably unconscious. At the receiving room a diagnosis of probable skull fracture is made, and X-ray films are ordered. The X-ray department makes the radiographs of the skull but neglects to examine the jaws. Even when the jaws are examined, a fracture in the condyle region may be missed and too often we find a fracture of the maxilla undiagnosed, especially in the edentulous patient.

In our clinic at the Receiving Hospital, Detroit, all patients with head injuries are given an X-ray examination for jaw fractures, and in many cases we advise a postero-anterior plate to determine whether or not the patient has a fracture in the condyle region. For this purpose right- and left-angle jaw plates are always taken. If any doubt remains, the roentgenologist orders a digital examination in the oral surgery department, regardless of whether the patient is in the hospital or the Out-patient Depart-

ment. We hold it inexcusable for the hospital to release a patient with an overlooked fracture of the jaw. All too frequently hospitals do release such patients. At the time of this writing, for instance, we are treating the wife of a prominent citizen of this city for a fractured jaw in the condyle region. Following an automobile accident, this patient had been hospitalized in a first class hospital for ten days, where she was treated for sprain and abrasions. Although X-ray films were taken of the skull, jaws, arms, and legs, the fracture of the mandible was not found. The woman complained of pain in the jaws, but jaws and skull remained negative in the diagnosis. We mention this in no derogatory manner, but offer it as constructive criticism. Too much care can not be exercised in our examination of these patients; jaw fractures should be detected before the patient is released from the hospital.

PRINCIPLES OF TREATMENT

The fundamental principles employed in the general treatment of fractures may be applied, with some modifications, to the re-



Fig. 5 Simple fracture of the rami of the mandible through the sigmoid notch. Treatment was conventional immobilization.

Fig. 6 Fracture of the rami of mandible through the sigmoid notch with displacement of condyle. These cases usually require a general anesthetic for relaxation and manipulation.

duction of fractures of the mandible and maxilla. These are:

1 Diagnosis from X-ray findings. General physical and oral examination.

2 Reduction of the fracture, or fractures, and possible manipulation for the fracture at the head of the condyle, or where there is an overlapping of the fragments.

3 Fixation of the parts splints (silver wire open reduction), interdental wiring, Barton's, or plastic Barton casts.

4 Post-operative treatment.

5 The use of exercising splints, in some cases, to restore the function of mastication and to hasten the return of normal muscular tone. Likewise, in a few cases, orthodontic appliances to restore normal occlusion.

CONSIDERATIONS BEFORE REDUCTION

First, for the benefit of the doctor, and as a matter of record, the patient should always be subjected to X-ray examination before reduction is attempted. The oral cavity should be made as clean as possible,

and all septic material, such as deposits of tartar and diseased roots, should be removed. All abrasions and wounds should have surgical treatment, according to the requirements of the individual case.

Many surgeons advise the removal of teeth and roots found in the line of fracture. In our experience, however, we have found that this procedure is not always advisable, and indeed, in many cases, actually contraindicated. We can show records of fractured mandibles in which such teeth have held the fractured portion of the mandible in the correct position, aiding us in obtaining the final anatomic relationship desired in the reduction of the fracture. Another factor to be considered is that sometimes the removal of these teeth is the cause of osteomyelitis, due to the frequent occurrence of considerable trauma in extraction. Many of the retained teeth are extracted later (possibly after a period of ten days). By this time they will have served their purpose, especially in fractures of the mandible at the angle, in which instance the posterior

fragment would tilt upward or forward were these teeth not retained

In a case, however, in which there is a tooth that prevents the approximation of the broken fragments or otherwise inter-

dental wiring because of the danger of shock and strangulation Reduction can be accomplished just as effectively later, without taking chances

Other important considerations in the

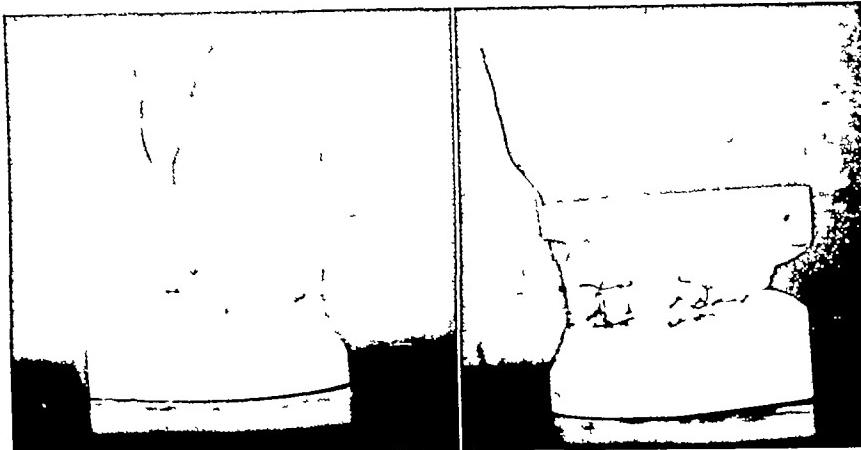


Fig 7 Interdental wiring

fers with bone alignment, we do not hesitate to advise extraction such a tooth should be removed

In gunshot fractures it should be remembered that when a bullet stops going it stops doing damage The spectacular operation for the removal of such a foreign body is rarely, if ever, warranted The patient should be allowed to recover from the shock, as often more damage is done in trying to remove the bullet than had it been forgotten Should, however, any metallic pieces from a spattered bullet be in line of fracture, or if the bullet or fragments of bullet or bone can be visualized or removed without a great deal of destruction to the surrounding tissue, then they should be removed

Jaw fractures associated with other complications, such as skull fracture, injuries to the chest, etc., require a few days of complete rest before an attempt is made to reduce the fracture It would be unwise immediately to start immobilizing with inter-

treatment of fractures are sequestra, cysts, impacted teeth, and possible growths Recently a patient presented himself, stating that he had a broken upper jaw Upon examination, we saw the largest fibroma on record in the mouth—it measured seven inches in circumference and weighed 131 grams It was attached to the roof of the mouth in the upper left molar region, and also across the roof of the mouth at the anterior border of the soft palate It was highly vascular, but not malignant The growth had caused considerable pressure atrophy, and the maxilla on the left side had become so weak that a very slight blow had been enough to cause the fracture

REDUCING THE FRACTURE

Occlusion—In reducing a fracture in an instance in which the teeth are present, careful attention must be paid to their occlusion This feature is most important, for, if overlooked, even if there is union of



Fig. 8-A Patient with fractured maxilla and large fibroma

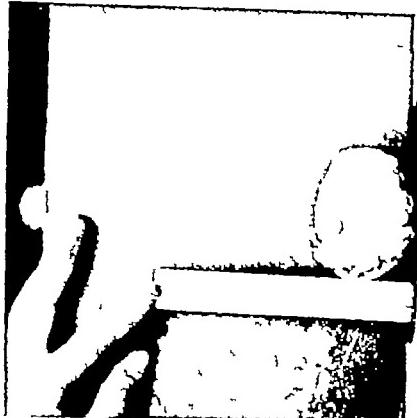


Fig. 8-B Fibroma 7 inches in circumference removed from patient's mouth

bone, the results will be unsatisfactory. If the teeth can be placed in normal occlusion or in the manner in which they occluded before the jaw was fractured, and can be retained in that position long enough for osseous union, the results will be satisfactory.

Anesthetics—Often a fracture may be reduced without anesthesia, with practically no pain. In cases in which anesthesia is indicated, we prefer the use of conduction rather than general anesthetics. With the former we are able to secure the co-operation of the patient, and have very little, if any, vomiting or nausea with which to contend.

When a general anesthetic is employed, we usually place the interdental wiring loops on the teeth before administering the anesthetic. After the patient has been anesthetized, we do such surgery or manipulation as is indicated. When the patient has sufficiently recovered from the effects of the anesthetic, the teeth are placed in occlusion and the connecting wires passed through the loops and twisted into place.

Interdental Wiring—Interdental wiring is the best method for immobilizing fractures of either the maxilla or mandible. The teeth are always placed in normal or original occlusion. If this is not accom-

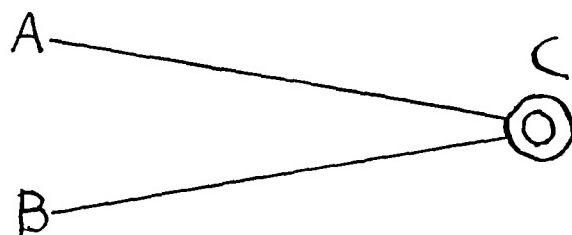
plished at the first sitting, the teeth will usually pull into position when the wires are tightened the second or third day, and the muscles of mastication will always be at rest. When the teeth are placed in original or normal occlusion the fragments of the bone must be in correct anatomic position, when the teeth are present no fracture requires more accuracy in reduction than that of the mandible.

The advantages of interdental wiring are—

- (1) Normal or original occlusion, correctness of median line, and harmony of facial expression are obtained.
- (2) Only a few instruments and 28-gauge wire are required.
- (3) Interdental wiring requires less time than the making of splints.
- (4) Interdental wiring is not annoying to the patient.
- (5) Interdental wiring is the most accurate and dependable of all methods.

Method of Interdental Wiring—Our favorite method for reducing fractures of the mandible is to support the mandible (teeth in occlusion) to the maxilla from three points—the bicuspids, or first molar region, on each side of the mouth, and the centrals in the anterior portion.

A piece of wire, 26- or 28-gauge, 10 inches long, is doubled and twisted around a small round instrument (a wooden applicator is a good size) about two or three turns, producing a small loop or eyelet at the end of the wire where it is doubled



The wire is now taken and the two ends ("A" and "B") are inserted at the buccal surface, passed from the buccal to the lingual surface, and then pulled through between the second bicuspid and the first molar, leaving the eyelet ("C") protruding a little just buccalward of the soft tissue between the two teeth. The wire ("A") is then pushed from the lingual to the buccal surface between the first and second molars, is pulled tight, and passed through the eyelet ("C"). The wire ("B") is passed

from the lingual to the buccal surface between the first and second bicuspids and pulled tight. With a small blunt instrument, the wires are pushed well up on the necks of the teeth and the two wires ("A" and "B") are twisted to the right and pulled outward at the same time until they are firm and secure. Our rule of twisting all wires to the right has proved helpful to us at our clinic. In cases in which some slight adjustment is necessary, whoever is on duty, whether he has seen the patient before or not, knows that wires always are turned to the right. We have found this rule very helpful.

The other wires are placed below in the same manner and on the opposite side and the anteriors passed between and around the centrals. We are then ready to occlude the mandible with the maxilla. Usually two wires are passed through the loop on the upper and then through the loop on the lower teeth (Figs 7-A and 7-B). The teeth are brought into correct relationship, and the wires are twisted tight by a turn to the right and a gentle pull outward. The wires



Fig. 9 Fracture of the mandible with posterior fragment tilted forward and upward.

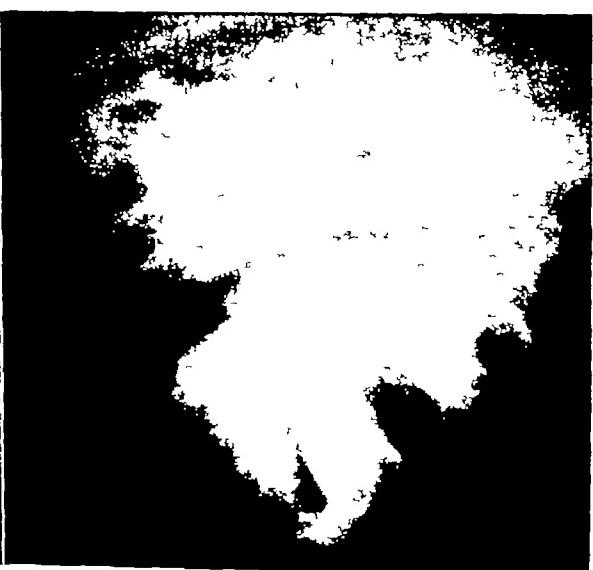


Fig. 10 Fracture of both mandibles at the mental foramen, with marked overlapping of fragments.



Fig 8-A Patient with fractured maxilla and large fibroma



Fig 8-B Fibroma 7 inches in circumference removed from patient's mouth

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different teeth at the gingiva, and twisting the wire tight around the bar. The bar may be attached to several teeth to hold the fragments and the teeth in correct position in the arch. Sometimes, if necessary, bars are used on both sides of the teeth, and are attached to the teeth in the maxilla and the mandible. After these bars have been attached so that the arches correspond and the teeth can be placed in occlusion, the mandible is attached to the maxilla, the 28-gauge wire being passed over and around the bars on the buccal and lingual surfaces, the wires being twisted tight, as previously described in interdental wiring.

Post-operative Care.—The average fracture requires four weeks in which to unite. We have had excellent results in three weeks, while other cases have required as many as nine weeks.

Although we have tried all kinds of special diets and light therapy to make bone unite more rapidly, none has proved very satisfactory.

We insist on a mouth wash every three hours. We see the patient usually every two or three days, if necessary, every day.

We employ aniline dyes, crystal violet and brilliant green for post-operative treatment, followed by a saline mouth wash. For this purpose sodium perborate (saturated solution) is prescribed.

FRACTURES OF THE MANDIBLE EDENTULOUS

Some operators prefer taking impressions and making vulcanite base plates for splints, adding the vulcanite bite rims, wiring the splints together by drilling holes through the rims and fastening them together with wires. In the central region the vulcanite bite rims can be omitted for the passage of nourishment, and the Barton plaster cast used over the head to immobilize the mandible with the maxilla. If the patient has dentures, holes may be drilled in the den-

tures, and then wired together. These make excellent splints.

Circumferential Wiring.—In this case only the base plate can be used. Silver wires



Fig. 13 Multiple fractures with severe facial lacerations

are passed through the soft tissues, one on each side of the fracture, under and around the mandible (intra-oral), and twisted tight over the base plate, holding the fragments in alignment with the base plate.

Open Reduction (Intra-oral) for Fractures of the Mandible (Edentulous Cases).—We have used the following method extensively and have found it satisfactory, therefore, we prefer it to other methods. In cases in which teeth are not present, an incision is made on the superior border of the mandible, extending two or three inches distally and mesially of the fracture. With a periosteal elevator the tissue is flapped back, exposing the bone at the point of fracture. The two ends are raised up and a surgical



Fig. 11 Fractured mandible, third molar in line of fracture

Fig. 12 Fracture of mandible in region of angle showing muscle pull

are then cut short and turned in so as not to interfere with cheeks or lips. All wires must be kept tight so that they will not slip.

In wiring the mandible to the maxilla in this manner it is a very simple matter to cut the three wires, if for any reason the mouth has to be opened. Only a few minutes are required to pass new wires through the same eyelets and retie the teeth in occlusion. Lacing the two teeth together as described, with "A" and "B" wires, to hold the eyelet in place, offers less opportunity for loosening of the teeth than if single teeth were used.

When the fracture of the mandible is in the condyle or sigmoid notch region, frequently the muscles will pull this fragment outward, sometimes forward, perhaps inward, even after the interdental wiring has placed the teeth in occlusion. If the distal fragment has moved outward, we advise an extra-oral splint or a plastic Barton ban-

dage, with a gauze sponge or other soft pad under the splint or Barton bandage at the location of fracture to act as a depressor until union has begun.

In fractures of the maxilla we employ the same method of interdental wiring, while with plastic Barton bandages we mold a plaster cast which holds the mandible against the maxilla. We have applied this method with good results in cases in which the maxilla has been fractured through both orbits and the nasal sections, allowing it to drop downward.

In cases of multiple fractures of the maxilla or mandible, we often use the small size bar, such as is used for a lingual bar in prosthodontia, or medium piano or platinum wire, shaping this to fit the arch of the mouth just labial to and buccalward of the necks of the teeth. It is then laced with 28-gauge wire to the necks of the teeth by passing the wire around the necks of the



Fig. 17 Barton plaster cast.

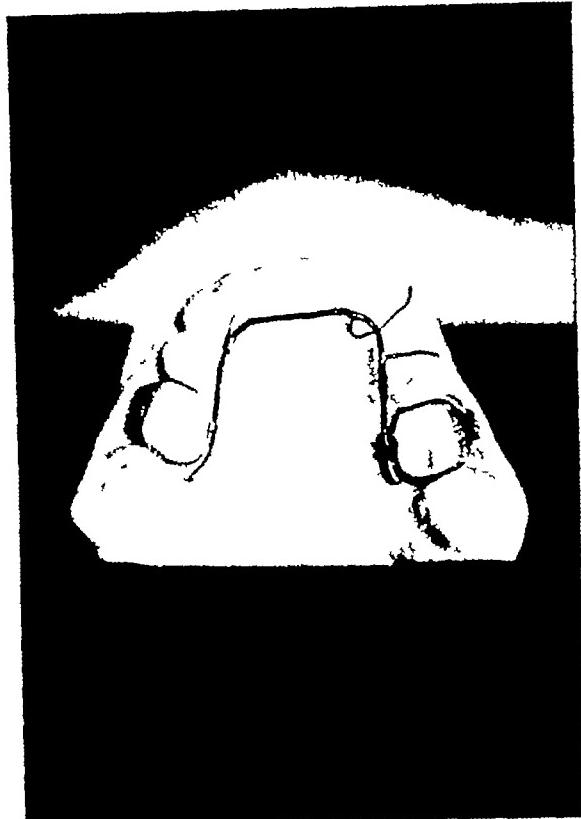


Fig. 18 Orthodontic splint used to correct and retain occlusion

ever possible, but seldom can wires be attached to the deciduous teeth. In many cases, the child will not be old enough to have teeth which can be used for interdental wiring. In these cases the fracture is reduced and held in position with Barton's bandage. A thin Barton may be used for a pad, over which adhesive 1 or $1\frac{1}{2}$ inches in width is applied. First the Barton and then the tape is passed under the chin and over the head, and then around the base of the head and forehead to keep the Barton from slipping forward or backward.

Fractures of the mandible that have not had professional treatment for several days, weeks, or even months are not uncommon. In some cases a Barton bandage may have been placed under the chin and over the head in such a manner as to cause an overlapping of the fragments. A fibrous union

has possibly started, with fragments out of alignment. The best results in these cases are obtained by removing the fibrous tissue and exposing the ends of the fragments, which are then freshened with a large burr or file. The flaps are returned and sutured into place, followed by the usual procedure of immobilization.

We have seen several cases of fracture of the mandible in which the head of the condyle has been completely destroyed by gunshot. Treatment of these cases is usually governed by the amount of damage or destruction caused by the bullet or slugs. Infection may or may not be present. The wound may be almost closed, or large and open, depending upon the size of the bullet or slug and the distance from which it was fired.

When a small bullet, such as a 32- or 38-



Fig. 14 Multiple fracture of maxilla and mandible

burr or drill is used to drill two holes in each fragment, one at the superior border and



Fig. 16 Intra-oral open reduction, 20-gauge silver wire

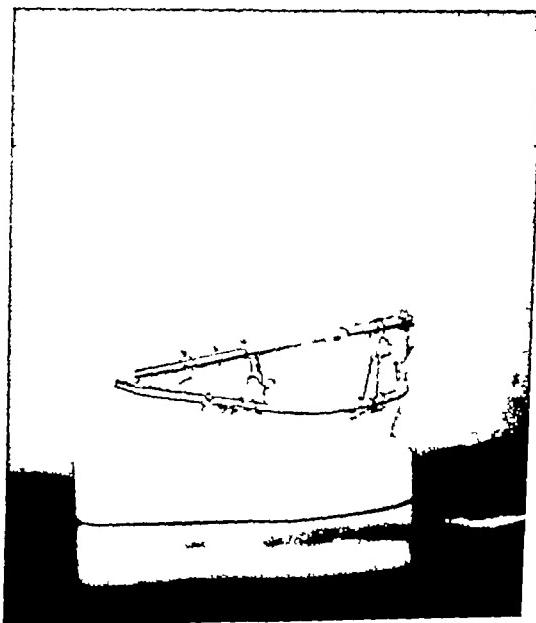


Fig. 15 Wiring method for multiple fractures of mandible or maxilla.

one at the inferior border of each. Two silver wires, 20- or 22-gauge, are used, one of which is passed through the superior hole of the mesial fragment and then through the inferior hole of the distal fragment. The other wire is passed through the superior hole of the distal fragment and then through the inferior hole in the mesial fragment. The ends of the bone are brought into anatomic relationship and the wires are twisted just tight enough to hold the fragments together. Now the surplus wire is cut, the ends are smoothed, and pressed against the bone. The flaps are put back in place and sutured. The usual post-operative treatment then follows.

We have had patients 60 and 65 years of age, all of whom have made excellent recoveries from fractures of the mandible that have been treated in this manner. While we are aware that some surgeons prefer to use this method extra-orally, we believe that it is seldom, if ever, indicated.

In treating children for fractured jaws, the interdental wiring should be used when-

specialist finds nothing wrong with the ear or adjacent structures. This condition is very puzzling to the doctor who may not be familiar with it. In these cases, the patient's mouth should be examined for the loss of teeth, improper articulation, and false movements of the mandible.

Slight unilateral dislocations of the temporal mandibular articulation are quite frequent, in fact, they might be classified as common. However, due to the fact that the pain or discomfort resulting from this is usually mild (in only a few cases is the pain very acute) and that this condition usually subsides without treatment, little or nothing is found in the literature on the subject. Often when patients complain of this discomfort, other causes are looked for, and frequently such diagnoses as neuralgia, arthritis, and myositis are made. The chief complaint in these cases is a radiating pain throughout the temporal region, greatly aggravated during movements of the lower jaw.

The nerve supply to the temporal mandibular articulation is derived from the auriculotemporal and masseteric nerves, the latter constituting a branch of the mandibular division of the fifth nerve, which communicates with the facial nerve.

When the lower jaw is depressed to a great extent, the interarticular cartilage is drawn forward and the capsular ligament may be injured, or even ruptured. Causes of dislocation of this nature include yawning, convulsions, undue pressure with mouth gags, choking and vomiting, and the taking of too large bites.

Another class of partial dislocation is that in which the displacement is forward and lateral. The teeth may have been worn smooth and the patient may favor biting on one side, there may be unilateral absence of teeth, compelling the patient to use but one side of his mouth for mastication, dental restorations may be too high or too low, resulting in a slight backward dislocation. In



Fig. 21. Fracture of the maxilla through the nasal and both orbital regions.

these latter cases the interarticular cartilage is usually injured. The teeth will be found to have been worn down to allow the lower jaw more nearly to approach the upper when the jaws are closed. Also, plates are made which prevent the jaw from assuming its natural position at rest. In edentulous cases in which plates are not worn, another cause may be found in systemic conditions which result in loss of synovial fluid.

It would seem that nearly everyone might be suffering from some discomfort in the temporal mandibular joints, however, this is not the case and usually dislocations do not occur unless the enumerated causes are quite exaggerated or the ligaments have been severely injured at some time, causing four of them to lose their tone. Patients complaining of this pain usually give a history of former injury. They also complain of having had slight neuralgic pain. In other words, the pain continues to be intermittent unless the cause is determined and corrected. At examination, the patient is required to open and close his mouth, disclosing the fact that the lower jaw drifts ever so slightly to the unaffected side.

Treatment consists in manipulation of the jaw to release any tissue within the joint and the carrying of the interarticular cartilage to its proper place between the condyle



Fig 19 Fracture of mandible Third molar holds distal fragment in position



Fig 20 Fracture of the mandible, showing considerable loss of bone, due to lack of immobilization

caliber, has entered the condyle region, with destruction of the head of the condyle and with no infection present, if the location of the bullet is non-vital, we have found it advisable not to disturb or open this region. Nor do we immobilize these cases, as we wish to form a pseudo-articulation or a false joint. The patient is put on a liquid diet, followed by a soft diet, then, in two or three weeks, a normal diet. The continual movement thus provided during the healing process prevents ankylosis from taking place.

With gunshot fractures of the mandible, in which the head of the condyle has been destroyed, the laceration of the tissue has presented itself within a few hours, our procedure is to sterilize the field of operation, remove all fragments of bullet and bone possible without further destruction of tissue, and, with a burr, smooth the head of the condyle or that portion of the bone which is left. Some of the fascia is then drawn over the smoothed head, being held in place with soluble sutures. Drainage should be established if indicated, or the wound closed. There is immobilization, and the same diet is ordered as for small bullet wounds.

INCOMPLETE DISLOCATIONS

Dislocations of the lower jaw are usually intracapsular because of the wide articular capsule which permits displacement without division of its surface, *i.e.*, dislocation in the most simple form. Through relaxed conditions, one or both condyles may lodge upon the intra-articular cartilage over the eminentia articularis. Relaxation of the external lateral ligaments and the enlargement of the articular capsule, with absorption of the anterior bony wall of the external auditory meatus, may be caused by loss of teeth, improper articulation, irregularity of teeth, or deformities of the maxilla. These conditions cause abnormal movement of the mandible and result in the enlargement and absorption of the capsule and adjacent bony structure of the glenoid fossæ.

When the joint capsule is relaxed and the surrounding muscles and ligaments have lost their tone, the condyle is allowed free movement and incomplete dislocation results. In these lesions, small parts of the articular cartilage are impinged, pain in the side of the head and in the ear often resulting. The patient then consults the otologist for relief, but, upon examination, the

INTRAVENOUS UROGRAPHY¹

By ROBERT E CUMMING, M.D., DETROIT, MICHIGAN

UROGRAPHY is an all-important part of diagnostic effort in the study of genito-urinary tract disorders. Roentgenologic examinations of the entire urinary tract are routine in every clinic and hospital, more common investigation of the genital tract, in both male and female, would be of great value and may safely be predicted. Lately Sargent has made exhaustive studies of the seminal vesicles and the vasa deferentia, and Jarre with his Cinex camera has shown interesting possibilities in serial work upon the uterus and oviducts. We are familiar with Belfield's immensely valuable seminal vesicle roentgenograms in connection with his vas puncture therapy. One has only to secure a few seminal vesiculograms to note the wide structural variations in these pouches, which, coupled with careful visualization of the vasa and their ampullæ, constitute graphic evidence of disease possibilities and have a potential secondary bearing upon the health of the patient concerned. The late B A Thomas, of Philadelphia, was another pioneer in vas injection work, while Rolnick has continued to further the efforts instituted by Belfield. I believe both urologists and roentgenologists should make use of genital-tract roentgenograms as a regular procedure, merging diagnostic with therapeutic measures.

As indicated, in order to give contrast shadows, corresponding in outline only, but of value in diagnosis, of the lumina of the genital and urinary tracts, some radioopaque substance must be present in the given lumen in sufficient quantity to fill that lumen at least reasonably well. For the genitalia, direct injection would seem the only possibility, and, until recently, that requirement for visualization of the urinary

tract has been fairly well obtained by means of liquid media introduced through catheters into either the ureter or bladder. From the time of the early perfection of this method, however, and in spite of its enormous success, urologists have predicted the development of some sort of intravenous administration of medium for contrast shadows. So finally after a period of colorful scientific investigation, including exhaustive experimentation, *intravenous urography* has come into its own. It is being used by all modern urologists, and independently by roentgenologists. I shall endeavor to show why it is not wise for these two groups to use the method independently of one another.

It is interesting to note that one of the sponsors of the most successful medium for intravenous urography was a pioneer with the older, or retrograde, method. I refer, of course, to von Lichtenberg, of Berlin, who, with Swick, brought us a safe and fairly reliable compound in uroselectan, the preparation in more or less common use today.

We have personally had access to it for more than a year, and our successes in intravenous studies have been largely with uroselectan. Another promising drug is skiodan, but, while we have had this in hand for a much shorter period, we are skeptical of its superiority. Its local and systemic reactions are mild to a point of non-existence, but at the present time we cannot depend upon it for good visualization. The third urographic preparation advanced for intravenous use is pyelognost, which was developed by Roseno, in Cologne, and, before uroselectan was available, was used rather extensively by him and others in Germany. I do not know of any extensive practice with this drug in America, but Jarre and I have used it in some sixteen cases, with re-

¹Read in abstract before the Grace Hospital Staff, February, 1931.

and the glenoid cavity. If the lesion is slight, manipulation, and instructions to the patient not to open the mouth wide for two days are usually sufficient. However, in se-

vere cases, the jaw should be manipulated, the teeth wired together by means of interdental ligation, and the jaw kept at rest for two weeks.

GROWTH-CONTROLLING EXTRACT BEING TRIED IN CANCER

A substance having remarkable powers of controlling the growth of living beings and of possible value in the treatment of cancer is being investigated in the laboratories of the Royal College of Surgeons of England and at King's College, London. The discovery is due to a young biochemist, J. H. Thompson, who has found that an extract of the parathyroid gland of cattle will restrict or prevent growth without endangering the health of the organism.

The most important application of this discovery lies in the treatment of cancer. It is being tested in several London hospitals

with very encouraging results. Sir Arthur Keith has further suggested that it may be of value in the treatment of the disease called acromegaly or gigantism which is due to abnormal functioning of the pituitary gland.

The effect of the extract was first observed on rats and rabbits, then on watercress. At the suggestion of Prof Julian S. Huxley it was tried on the axolotl, a form of salamander. In all these cases the growth-retarding effect has been very marked. Treated rabbits have remained at about half the size of their untreated brothers and sisters. The germination of watercress seeds is entirely stopped by a 20 per cent solution of the extract.—*Science Service*

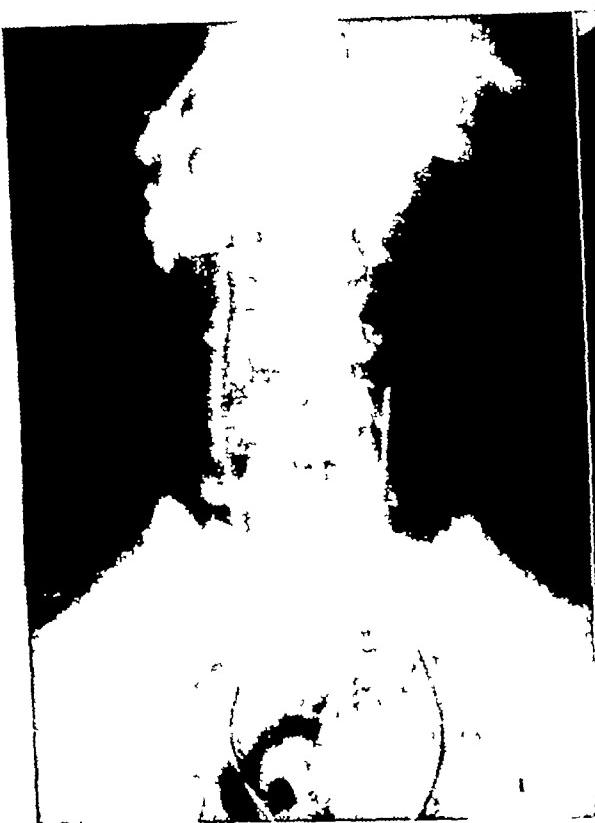


Fig 2-A Pyelo-ureterogram taken in 1927, showing pyelectasis with stricture at the uretero-pelvic junction



Fig 2-B The same case, 1931. Bilateral pyelo-ureterograms taken 30 minutes after the administration of skiodan. The 15-minute film showed excellent pyelogram of better kidney. Note the marked increase in hydronephrosis and failure of ureter to fill. This film is the best of the series for hydronephrosis demonstration

instrumentation incident thereto, does not often produce colic, which, in the absence of endogenous foreign matter, is brought about by local reaction following the introduction of a contrast medium. This reaction may be edema, spasm, hemorrhage, or a combination of these, and it occurs whether the injection is made with fluoroscopic control, although less often, or by the gravity method or the syringe method. One theoretic contrast is that catheter and retrograde media disturb physiologic activity, while intravenous media do not.

The particular boon of intravenous urography, then, is its applicability for patients who for one reason or another, cannot be subjected to ureteral catheterization, or in whom are found insurmountable mechanical difficulties. We may cite intolerant

bladder patients, those with severe vesical neck or ureteral obstructions, those with ureteral orifices in diverticula of the bladder, and those with transplanted ureters, as case illustrations of these types. Another, and important, type is the paralytic bladder group of cases, still fatally infected in most hospitals, in which data relative to the upper urinary tract are sometimes of importance. In this connection, it may be stated that even if a diagnosis in a given case can be made certain by intravenous urography, the later use of cystoscopic manipulations will, in a surprisingly large percentage of instances, be quite necessary.

Uroselectan, and probably skiodan, is apparently filtered through the glomerulus, and



Fig 1-A Complete urogram, 15 minutes after the administration of uroselectan in a boy aged 14 years, which shows recent injury of the urethra and fracture of the pelvis. Filiform stricture of urethra. Kidneys well preserved. Note distortion of ureters (kinks).

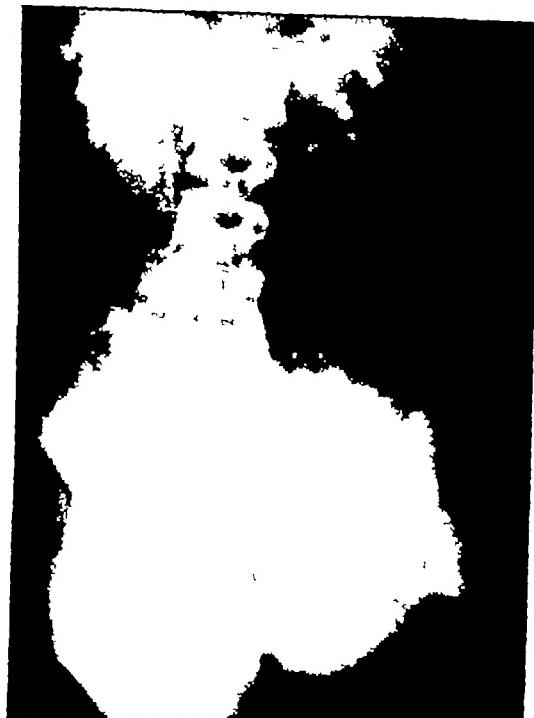


Fig 1-B Same case urogram made 15 minutes later. The pelvis and ureters are less distended and the ureteral kinks (?) have straightened. The earlier film is undoubtedly taken during "diastole," the second one probably during "systole," or at a period of lesser intrarenal activity.

sults which have heretofore been published, and which will be alluded to later in this paper. Suffice it to say here that we feel it to be definitely too toxic for wide usage, and less reliable as a medium for obtaining good roentgenograms than uroselectan or skiodan.

An important and natural question has arisen as to whether or not intravenous urography will supersede the older method. After we have placed so much faith in the latter for many years, is a new and relatively untried method desirable? The retrograde types of uograms are not perfect, while the newer ones, with an intravenous medium, in many instances, leave much to be desired. Intravenous urography, then, is not to displace the retrograde method, but rather to serve as an adjunct to it. From a different standpoint, intravenous urography was not

devised to make it easy for a roentgenologist to render a complete diagnosis in a case with a suspected renal lesion, although his analysis of the film series is of inestimable value, the new method is the product of urology, which in turn reaps the principal benefits of intravenous urography. These lie in the fact that a patient may be spared the added chance of a painful reaction to cystoscopy which is, of course, the necessary preliminary to retrograde urographic studies, except in a small percentage of cases. Also, in some types of cases, cystoscopy is unsatisfactory, and ureteral catheterization unsuccessful, and sometimes dangerous. Parenthetically we may be reminded that renal colic is due to obstruction in the transport passages of the urine, and that catheterization of the ureters, and the



Fig 3-4 Bilateral hydronephrosis, probably congenital Retrograde studies



Fig 3-B Same case in erect posture, catheters withdrawn Note the extreme rotation and ptosis on the right side Intravenous studies failed to demonstrate the degree of ureterectasis or any rotation

ular drug We are positive upon two points, namely, in normal individuals and in those with temporary or permanent cortical renal damage of an extensive nature, good, readable films cannot be at all regularly obtained It is in either of these two classes of individuals that the roentgenologist, independently, may be guilty of error in attempting a clinical diagnosis Careful selection of cases is necessary to avoid great waste of time and material in the practice of intravenous urography and one cannot anticipate with any degree of accuracy if in a given case satisfactory data may be provided Indiscriminate use of the method should be heartily condemned

A weakness related to the intravenous technic lies in its lack of aid in determining the so-called emptying time of a renal pelvis and ureter At the present time when so much stress is being put upon conservative renal and ureteral surgery, in connection with ptosis hydronephrosis, stricture, and

anomalies, the details of physiologic activity are important In a recent case of bilateral hydronephrosis with extreme ptosis and tenacious infection, our point of departure upon operative interference depended largely on our finding a marked delay in the emptying time of each pelvis After both kidneys were suspended, the infection was controlled at once Emptying time determinations with the Cinex camera a few months later seemed to us to be all-important, showing, as they did, very rapid and equal physiologic expulsion of the injected medium Nevertheless, and rightly, von Lichtenberg states that one is able to interpret the dynamics of the urinary tract by observing the expulsion of uroselectan He immediately follows this statement, however, by warning that good films may be expected only when the kidney

is a sort of index to glomerular function, so that in cases with gross involvement of the renal cortex its use is unsatisfactory. So, also these drugs fail to produce satisfactory roentgenograms in those disease processes in which for any reason the eliminative activity is in abeyance. We have been disappointed almost uniformly in cases of renal tumor, renal tuberculosis, bladder carcinoma with renal damage and suspected renal or ureteral tumor, acute pyelonephritis, and prostatic obstruction with renal failure. In spite of our experience it is probable that earlier cases of tumor and tuberculosis would have shown sufficient concentration of the medium for worthwhile information, but we are of the opinion that in either disease we will always desire confirmation by means of retrograde studies when they are available, since radical surgery is necessarily involved. A very recent case, with intolerant bladder so acutely inflamed and hemorrhagic as to make recognition of the ureters and catheterization impossible, was studied with pyelognost and, later, skiodan. Carefully timed films over periods of many hours failed to show any shadows of kidney pelvis or ureters in spite of a fair urine output. A diagnosis of bilateral multiple infected infarcts, superimposed upon a severe pyelonephritis, was made, and confirmed at autopsy. Thus we see that all methods of roentgenologic study are subject to failure.

Much was promised in connection with the intravenous media especially uroselectan, as adjunct functional tests for renal activity. The reports to date have not been convincing and the chemistry involved is too arduous, although some interesting facts were brought out by investigations instituted by us at the Detroit Receiving Hospital. Our method of recovery of the drugs and determinations of their percentages of excretion in given periods will be reported later. It would seem of value to obtain the voided urine following the administration of

uroselectan especially, and, by securing samples at as regular intervals as possible, to construct a specific gravity curve as an index to elimination time. In cases of prostatic obstruction we consider all the data available concerning the upper urinary tract of great importance, and intravenous urographic routines have given valuable prognostic data merely by the success or failure to obtain good roentgenograms.

Our personal investigations in this field, with the invaluable aid of the Roentgenological Department, and Dr Jarre, especially, have brought out one point which seems to be of the greatest significance. It is that the normal individual filters the drugs used so rapidly as not to allow complete visualization of the tract lumina so that in many normal studies our findings were most imperfect. The use of the Cinex camera, with its many exposures, allows a pieced together picture, which gives fairly complete detail. This camera would provide the ideal means for all intravenous urographic studies. Our original serial roentgenographic findings with pyelognost and uroselectan have been reported before the American Urological Association and will appear in the official journal of that organization. The most brilliant and successful films have universally been those obtained in cases with good, or reasonably good, renal function on the involved side, but partial obstruction, or apparent obstruction in the ureter or at the bladder neck. Such cases are those with ureteral spasm, stricture, or calculus, often accompanying hydronephrosis, hydronephrosis itself without easily demonstrable block, prostatic obstruction in any of its forms, and urethral stricture. Many other observers have reported the same sort of successes, although it must be added that the original workers in the field, and the current advertisers, give one the impression that any and all kidney pelvis and ureters are readily visualized by their partic-

them full during the intervals between exposures. Whether this is an aid or not, we cannot state, since in our hands so many failures still occur. One German writer proposed such a method of compression, and reported it favorably some time after our own experimental use of rectal pressure was begun.

These observations, from a personal standpoint, are based upon the use of—

Pyelognost in 15 cases

Uroselectan in 83 cases

Skiodan in 25 cases

The majority of these intravenous studies have been made in the Grace Hospital, and our early practice was with the use of the Cinex camera in all cases in which good films were found possible. These included a considerable series of normal individuals, and reference has already been made to a report of our findings. Several patients have been examined by this method in several other hospitals. In a number of instances, the drug has been injected in one of our offices, the patient being sent at once to a nearby X-ray laboratory, where films were taken within fifteen minutes of the injection and at stated intervals thereafter. In addition we have had access to uroselectan and skiodan studies made by other local urologists. While there is reason to feel that best results are obtained with many repetitions in the same surroundings and with an exact technic, we believe there is some advantage in the opportunity to observe such a relatively simple procedure in several different places. One may have the co-operation, for instance, of numerous excellent roentgenologic specialists. Our injections have all been made with the gravity method.

Concerning pyelognost, it is necessary to say only that we have discontinued its use. We obtained excellent results in cases with impacted ureteral calculi and early hydro-nephrosis, but the reaction is rather horrible for the patient, and our percentage of fail-

ures was greater than with either of the later drug compounds.

Judging the more than one hundred cases in which uroselectan and skiodan have been used, we may rightfully conclude that for urinary lithiasis, pyelectasis, and ureterectasis, together with the various anomalies, intravenous urography has been gratifyingly successful, provided there has been reasonably good function as indicated by our standard colorimetric and chemical blood analyses. Braasch found the method of value for—

- 1 Identification of shadows
- 2 Determination of the intrarenal situation of shadows
- 3 Ascertaining the differential renal function
- 4 Demonstration of coincident disease or anomaly in the affected kidney
- 5 Determination of the functional capacity and disease or abnormality in the kidney

In an analysis of forty cases of renal lithiasis, we are particularly in accord with Braasch except that, for differential renal function, intravenous urography cannot be depended upon in our hands. In his series, Braasch observed two cases in which evidence of uroselectan could not be seen in the affected renal area, and in which at operation the kidneys in question were found to be normal.

In addition to our foreign urologists, several in America have stressed the importance of diagnostic data obtained with uroselectan in cases of renal tuberculosis, among these are Lowsley, of New York, and Sweetser, of Minneapolis. We have not had such good fortune, as already stated, but remain hopeful inasmuch as with this disease there are many favorable arguments against ureteral catheterization. Herbst reports a case indicating that his experiences tally with our own as far as positive urographic evidence goes. He also states that in a case



Fig 4-4 Uroselectan urogram showing large stone in the pelvis of the right kidney. This bizarre type of pelvis is well visualized, as are the ureters and the bladder.



Fig 4-B Lateral exposure showing the same pathology in the same case (Courtesy of Dr Weltman)

function is satisfactory. Only too often we need diagnostic information most when the renal activity is not satisfactory. Von Lichtenberg also points out that the mechanics of the ureter can be studied by intravenous urography, but I submit, as an apparent fact, that these physiologic notations can be made only if and when the intravenous medium concentrates sufficiently in the urinary tract lumina.

As a part of the technic for intravenous work, the early writers advised having the patient under examination void before exposures, so as to allow visualization of the lower ureters in their entirety; later workers have stated that by holding the drug-bearing urine there will be better visualization of the ureters, at least down to the bladder shadow, this being based upon the theory that the full bladder slows the excretion

from the ureter. We do not agree with this theory, nor has the practice borne fruit in our hands, although, in some cases of incontinence, failure to secure good roentgenograms was ascribed by our X-ray colleagues to this same incontinence. Other means for the compression of the lower ureteral segments have been widely advocated, principally the use of rubber bags for lower abdominal pressure. This technic has been stressed in England, and lately Herbst, in the American *Journal of Urology*, has spoken of its value. We are unconvinced of the worth of this method, and feel that it may add to the already frequently disturbing factor of flatulence which so often develops rapidly, especially after the administration of uroselectan. To attempt a more direct means of compression we have used air-distended bags in the rectum, keeping

our finding it a bit more trustworthy seems an accurate observation Skiodan, however, is cheaper, and can be kept indefinitely after it is put into solution, an older preparation of uroselectan after several sterilizations, even with proper addition of water, produces greater reaction than when freshly used. In the matter of reactions too, there is some difference, since with skiodan there is none whatever, while uroselectan usually causes pain at the site of injection and in the upper arm, along with the well-known though transient general reactions. It appears also, that skiodan filters through the kidneys somewhat more rapidly than uroselectan, a fact which may account for some of its failures with us. As yet there is not much material in the literature concerning skiodan which was informally reported as very successful at the Mayo Clinic a good many months ago. However, Ochsner and Wishard have recently emphasized the importance of taking very early films after its administration, and the manufacturers have stressed this point as of additional value for the drug.

Pyeloscopy, a valuable asset in urography, particularly in the study of pelvic and ureteral function, has been discussed by us in previous articles, it has been often referred to in the foreign literature, especially the French, and several times in our own journals in connection with excretion X-ray studies. It does not appear to fit in very well with intravenous urography, because of insufficient density of the media. We have been able in many cases to determine the most appropriate time for serial films on the Cinex camera with preliminary fluoroscopic study, but cannot get clear detail for evaluation of pelvic or ureteral outlines in most instances. This latter is so nicely possible with retrograde urography that the devotees of pyeloscopy are loath to take up the intravenous methods. With pyeloscopy



Fig. 6. Uroselectan study, 30 minutes after injection showing complete calcification of the right kidney (healed tuberculosis). The left pyelo-ureterogram and cystogram were excellent. No drug was secreted on right side.

and retrograde urographic diagnosis, the examination of the patient in both prone and erect positions has become routine. We have without valid excuse failed to practise the taking of exposures in the erect position with many intravenous studies, thereby overlooking an important step for deriving the most value possible from the film studies. It is apparent that this weakness is more or less universal, and we have seen specific instances in which, after definite conclusions had been reached in a given case, further important data were reached only after confirmative retrograde studies in the two positions. In one recent case an intravenous series failed to show much ptosis in the upright posture while a later retrograde film, similarly taken, showed not only marked



Fig 5-A Retrograde pyelogram in a double kidney which shows the lower pelvis to be pyelectatic

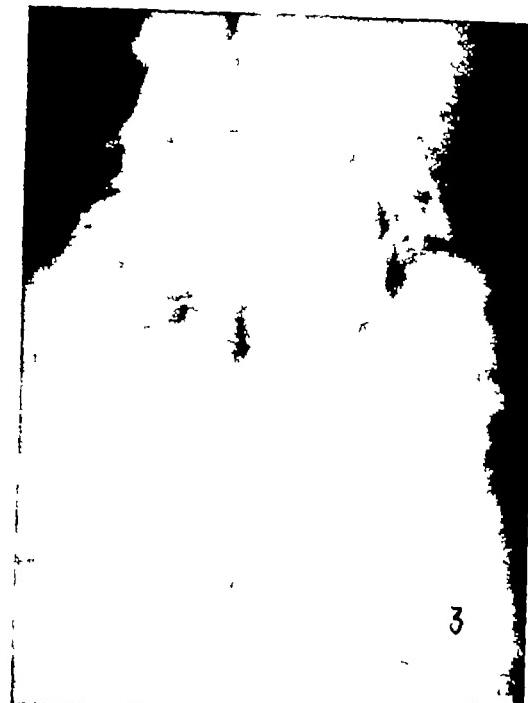


Fig 5-B Same case, uroselectan study allowing visualization of multiple calculi in the diseased pelvis. The calculi are visible in the plain films (Courtesy of Dr Plaggemeyer)

of polycystic kidney, and in tumor (renal) cases, the pelvic fillings were not sufficient to be of diagnostic value

Herbst's remarks upon the comparative value of intravenous urography (with uroselectan) are very timely, and we especially admire our former teacher, Bugbee, for his early warning against over-enthusiasm for this type of urography, which he called but a method of corroboration to supplement our proven methods of diagnosis. Viethen, in Germany, Hyman and Beer, in this country, have stressed the value of intravenous urography in children, yet we have found a high percentage of failures with both uroselectan and skiodan.

Since so much of the early work in excretion urography was done with oral administration of contrast media, referring particularly to the efforts of Rountree and his

associates, and since there are some things lacking in our present methods and preparations, it is well to bear in mind that along with the hoped-for improvement in intravenous media may come the evolution of a regularly successful drug for oral use. Several of the foreign writers have discussed this phase of the subject at some length.² Oral urography will make its appeal especially for the obscure medical cases undergoing complete study, the intravenous methods have failed rather dismally in our hands, for this type of patient, in contrast to Kidd's prediction of a year ago.

A word is in order as to the relative merits of uroselectan and skiodan. Whereas we have had more experience with the former there is so little difference in the technic and activity of the two drugs that

²See bibliography, page 52.

| | | |
|------------------------------------|-------|----|
| 3 Skiodan | | |
| Renal tuberculosis | - - - | 1 |
| Lithiasis | - - - | 4 |
| Acute pyelonephritis | - - - | 1 |
| Prostatic hypertrophy | - - - | 4 |
| Hydronephrosis | - - - | 5 |
| Ectopic kidney | - - - | 1 |
| Nephroptosis, severe | - - - | 2 |
| Pyonephrosis, after spine fracture | - - - | 2 |
| Tabes dorsalis | - - - | 1 |
| Acute nephritis | - - - | 1 |
| Subacute pyelonephritis | - - - | 3 |
| Total | - - - | 25 |

In this series also, one notes a wide variety of disease, and may make fair deductions as to the adaptability of the medium for good contrast shadows. Thirteen cases of the 25, or 50 per cent, we have marked as failures. They include the case of ectopic kidney, which incidentally was a single congenital kidney, the cases of acute nephritis and pyelonephritis, that of tabes, which was a patient with good renal function, one case with pyonephrosis after spine fracture, two cases of prostatic hypertrophy, the case of renal tuberculosis, and one case each from the hydronephrosis and lithiasis groups.

In analyzing part of the material recorded here, a few months ago, we classified many of the instances in which intravenous studies were made as partially successful, obtaining a better set of percentages for intravenous urography. We are convinced that this was a bad precedent, and now classify all investigations as either diagnostic or failures. Naturally, in many instances, one kidney and ureter will be visualized while the other is not, but this means diagnostic information, and usually helps in placing the disease process. In this earlier analysis, we tabulated 14 cases in which retrograde study may not have been necessary prior to the institution of therapy as completely diagnosed as to roentgen-ray information. This number was much below the 50 per cent level which our larger group of cases supplies in that it represented cases culled from a total of 38. So one may assume that, by selecting cases for intravenous study, a much higher rate of successes may occur. For the



Fig. 7 Pyelogram urogram, showing excellent demonstration of the bladder and remaining kidney, after nephrectomy.

14 cases cited, a total of 41 cystoscopic procedures, operative and for therapeutic manipulations, were necessary in the periods of treatment. It is evident, therefore, that intravenous urography does not displace cystoscopy in the care of genito-urinary disease.

The habit of illustrating a paper upon our current subject with excellent roentgenograms has become general, it would seem to be a dangerous one, as the casual reader is prone to think that all intravenous urographic studies are as satisfactory. We shall err, however, along the same line, presenting some of our successful films, since the other (and larger) group is worthless, except in relation to the case represented, as negative data.

One step in urography has been neglected, especially in this country, and that is the study of urethrograms. These films, which

ptosis but also an extreme rotation of the kidney

A tabulated summary of cases subjected to examination by intravenous urography follows

| | |
|--|-----|
| Total number of cases | 123 |
| Classification, without reference to medium | |
| Normal subjects | 18 |
| Lithiasis | 19 |
| (a) Unilateral | 6 |
| (b) Bilateral | 16 |
| Pyelonephritis, subacute and chronic | 3 |
| Pyelonephritis, acute | 2 |
| Hydronephrosis, with high obstruction | 8 |
| Hydronephrosis, with involvement of ureter | 4 |
| Hydronephrosis, bilateral | 5 |
| Renal tuberculosis | 3 |
| Renal tumor | 3 |
| Carcinoma of bladder | 1 |
| Carcinoma of bladder, ascending infection | 2 |
| Reduplication of pelvis and ureters | 7 |
| Prostatic hypertrophy, with retention | 1 |
| Ectopic kidney | 2 |
| Extreme nephroptosis | 3 |
| Pyonephrosis secondary to ascending infection after spine fracture | 5 |
| Urethral stricture | 1 |
| Bilateral acute septic renal infarction | 2 |
| Acute nephritis, subsiding | 1 |
| Tabes dorsalis, with bladder symptoms | 3 |
| Cases with single kidney, congenital | 1 |
| Studies made for investigation of remaining kidney, with findings as follows | 1 |
| (a) Normal | 5 |
| (b) Infected | 1 |
| Cases following implantation of ureters | 2 |

Obviously we have included a wide variety of lesions, this, together with the normal case studies, was a deliberate attempt to determine the value of the method in routine diagnosis. In the normal subjects, the best results were obtained in those cases examined following nephrectomy (detailed reference to that series has been made in the former paper)

Next in line come the groupings which include ureteral obstructions or obstruction at the bladder neck, or in the urethra

TABULATION OF CASES WITH REFERENCE TO VARIOUS MEDIA

| | |
|--|----|
| 1 Pyelognost | 6 |
| Normal subjects | 4 |
| Lithiasis | 4 |
| Case following implantation of ureters | 1 |
| Suppurative focal nephritis | 1 |
| Cases found normal following nephrectomy | 2 |
| Infected remaining kidney | 1 |
| Total | 15 |

Of this series, the normal group proved almost universal failures. Failure also occurred in the instance of transplanted ureters, and in that of focal suppurative nephritis. Satisfactory films were obtained in one of the nephrectomy series, and three of the lithiasis series, these three being instances of impacted ureteral calculi.

| | |
|--|----|
| 2 Uroselectan | 12 |
| Normal subjects | 17 |
| Lithiasis | 4 |
| Renal tuberculosis | 2 |
| Renal tumor | 4 |
| Carcinoma of bladder | 2 |
| Reduplication of pelvis, ureters | 2 |
| Acute pyelonephritis | 5 |
| Prostatic hypertrophy | 5 |
| Hydronephrosis | 9 |
| Urethral stricture | 5 |
| Pyonephrosis after spine fracture | 1 |
| Acute suppurative nephritis | 1 |
| Subacute and chronic pyelonephritis | 13 |
| Tabes dorsalis | 2 |
| Cases with single kidney | 3 |
| Case following implantation of ureters | 1 |
| Total | 83 |

Omitting the twelve cases which were normal subjects, and one of the cases having reduplication of pelvis and ureters, but no pathology, we have a total of 70 cases with disease in the urinary tract, of these, 29, or approximately 50 per cent, did not give films that might be called diagnostic. The groups in which failures were most common include all cases of renal tuberculosis and renal tumor, a large proportion of the pyelonephritis series, and pyonephrosis, both when secondary to spine fracture with ascending infection, and associated with prostatic obstruction and stricture of the urethra. One note the largest series as that of lithiasis, and here we found our best results, the high percentages being in cases with ureteral or small pelvic calculi. Another large group is that of hydronephrosis, and here also we found good results, with the best in the presence of definite ureteral pathology. The cases with low obstruction also gave good visualization when renal function was well preserved.

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are simple in execution, are important in both pre-operative and post-operative phases of bladder neck and urethral obstructive lesions, important, too, in the recognition of diverticula in both sexes. The British urologists have stressed urethrograms, and Young's clinic, in Baltimore, has obtained valuable data by their use.

SUMMARY

The experience represented by 123 consecutive intravenous urographic studies has been recorded in sufficient detail to indicate the value in a new method of diagnosis. Certain types of renal disease have been shown as promising little or no diagnostic evidence after the administration of any of the contrast media now employed. Of these we may mention particularly renal tuberculosis, renal tumor, acute inflammation, and marked renal insufficiency as portrayed by advanced pyonephrosis, septic renal infarction, and advanced prostatism.

Present-day conceptions of the general practitioners in the medical profession include a tendency to over-enthusiasm for intravenous urography, which is not shared by a large group of urologists. It is apparent that this method of diagnosis should not be practised by urologists and roentgenologists independently, and that general laboratories are to be condemned for attempting to place lesions of the genito-urinary tract by means of intravenous urography.

Before uroselectan was available, we used pyelognost in our practice, later continuing, to compare it with the former. More recently we have used skiodan. Of these three preparations we find uroselectan the most satisfactory, and plan to confine ourselves to that drug (now called "Iopax"). It must be admitted that skiodan is better tolerated, but, as has been reported by so many others, and lately ourselves, uroselectan is apparently quite safe. With all three

drugs we have seen temporarily alarming reactions.

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NEW RADIUM IN CANADA WILL BREAK WORLD MONOPOLY

That radium to the value of hundreds of millions of dollars, just discovered in Canada, will break the Belgian world monopoly of this precious substance and speed up the relief of cancer victims is the opinion of competent mining experts in Washington

The pitchblende treasure bearing \$150 worth of radium in every pound of ore, discovered by Gilbert Labine and Shirley R Cragg, airplane prospectors, at Labine Point in the Great Bear Lake region, is equal in richness to the best ores of the Belgian Congo, which since 1922 have driven all competitors, including the United States, from the market

The new ore is here described by geologists as "a very substantial deposit of high grade material" yielding 3 to 4 grams of

radium per ton Twenty tons have already been shipped on a fur steamer of the Mackenzie River, and forty more tons have been mined and are ready for shipment, at a cost which compares favorably with Belgian freight charges on the long passage from Africa to the refineries in Europe

Hundred-pound lumps were actually picked up on the surface The radium from these will yield \$70,000 a gram, whereas the most valuable emeralds fetch only \$5,000 a gram Silver ore yielding \$300 a ton has been found alongside

The Canadian discovery, consisting apparently of several thousand tons of ore, will add greatly to the world's present 600-gram total supply of radium Treatment of cancer, until now hindered by the prohibitive prices, will be greatly helped — *Science Service*

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AS NEPHROPTOSIS AND URINARY STASIS

upper third of the lumbar fossa, a space which is bounded behind by the muscles of the loin and back, in front by the peritoneum, above by the diaphragm, and below

peritoneum, and the right kidney lies a finger's breadth lower than the left said to be due to the fossa on the right being less capacious on account of the

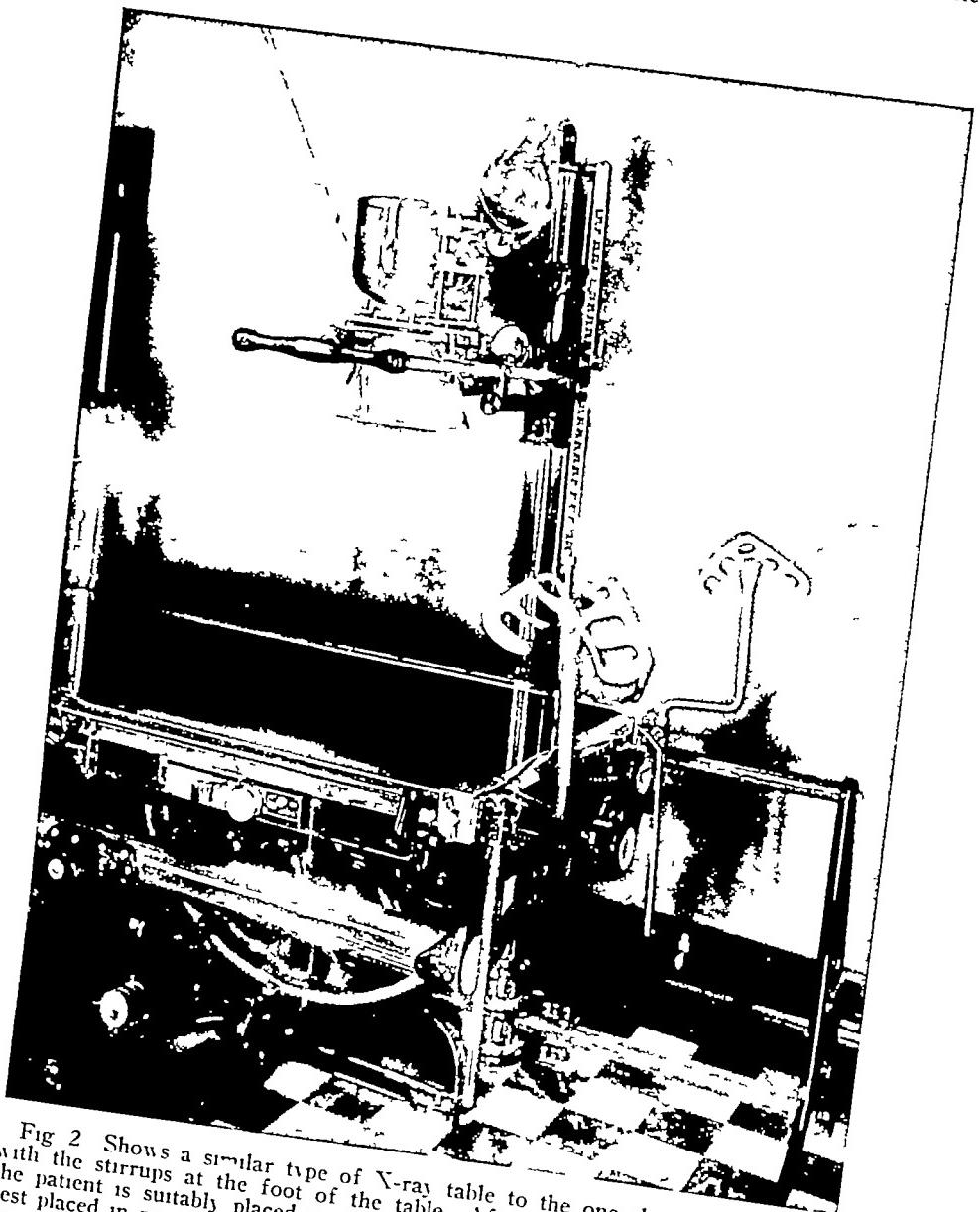


Fig 2 Shows a similar type of X-ray table to the one shown in Figure 1 with the stirrups at the foot of the table. After the cystoscopy is completed the patient is suitably placed on the table, the stirrups removed, and the foot rest placed in position. Pyeloscopy and pyelography are then carried out in the usual position.

by the ilium. The kidney extends from the upper margin of the twelfth rib to the lower margin of the second lumbar vertebra. The kidneys are situated entirely behind the

ence of the liver and an inclination of the vertebral bodies to that side.

The peritoneal relations are somewhat different on the two sides. On the right side

THE DEMONSTRATION AND SIGNIFICANCE OF NEPHROPTOSIS AND URINARY STASIS

By HAROLD L MORRIS, M D, F A C S, DETROIT

IN the study of urinary stasis of the upper urinary tract, one must be familiar with the normal anatomic relationship of the kidneys and other organs, as well as the supporting structures of the kidneys.

The recognition of nephroptosis, and the various forms of treatment for the same, is as old or older than urology itself, however, the roentgen-ray demonstration of nephroptosis is a more recent development.

It is the purpose of this thesis to again call attention to the anatomic relationship

of the kidneys and other organs, as well as the supporting structures of the kidneys, the histologic structure of the renal pelvis and ureter, also the physiologic action of the renal pelvis and ureter. As there may or may not be a stasis of urine in the renal pelvis, as a result of nephroptosis, a method is proposed for determining this factor which should be carried out in cases in which investigation of the higher urinary tract is indicated.

As shown by Southam (1), the kidneys lie in the lumbar region on either side of the vertebral column. Each kidney occupies the

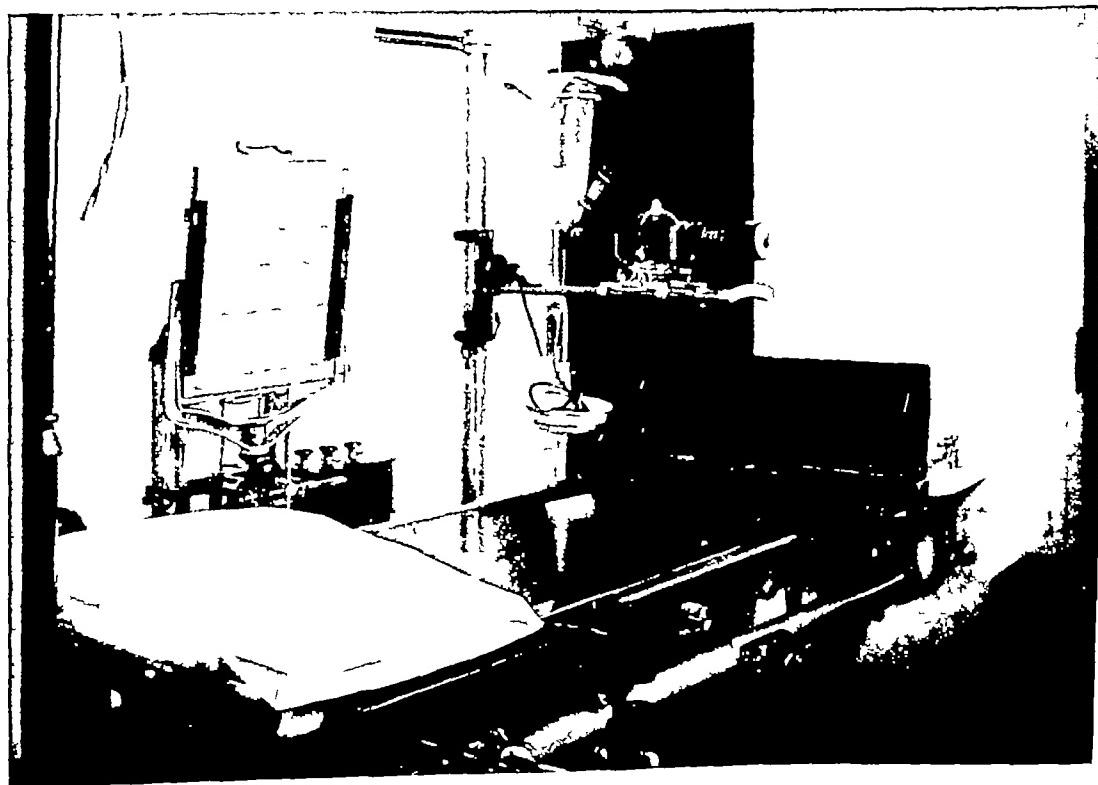


Fig 1. A motor-driven, tilt X-ray table, with a suitable drum installed at the foot of the table for cystoscopy to be performed with the patient in the prone position, legs extended. The Bucky moves the full length of the table, the tube stand, which is attached to and moves with the table, locks in position over the center of the Bucky. The fluoroscopic screen has underneath two slots for carrying a 10×12 cassette so that films may be made during the course of fluoroscopy, using the fluoroscopic tube for making the exposure.

has the appearance of a cone with the apex above, while in the male it is more cylindrical in shape and tends to become narrower below. This is due to the increased breadth of the female pelvis, and in some cases an acquired narrowness of the lower costal margin. In the male, the lower ribs are more horizontal and the chest has a greater width, while the measurement across the iliac crest is relatively small. In the female, the intercostal diameter of the body may be greater than the transverse diameter of the lower thorax by two and one-half centimeters. In males, the fossæ are distinctly pear-shaped and become narrower below, while in females they are relatively narrow above and broaden out below or are cylindrical in shape. Further, a comparison of the fossæ on opposite sides of the body shows the right recess is usually a little larger than that on the left side.

In most cases the fossa of the right side is more capacious than that on the left. Southam demonstrated this fact by making transverse sections of the casts, cut with a band-saw at the level of the first lumbar vertebra. In the male, the right recess was thus shown to be appreciably larger than the left, the average measurement in the right side being about two centimeters broader than the left at the level of the first lumbar vertebra. The fossa of the right side is deeper than that of the opposite side at the same level by one centimeter.

The upper end of the kidney is rather greater than the lower in circumference, more curved, and nearer to the vertebral column. It corresponds to the intervertebral disc between the eleventh and twelfth thoracic vertebrae. The lower end is bounded by the intervertebral disc between the second and third lumbar vertebrae.

The fixation of the kidney depends on two factors: first, the fatty capsule through which runs connective tissue fibers from the fibrous capsule to Gerota's capsule; second, Gerota's capsule. This is the fascial envelope

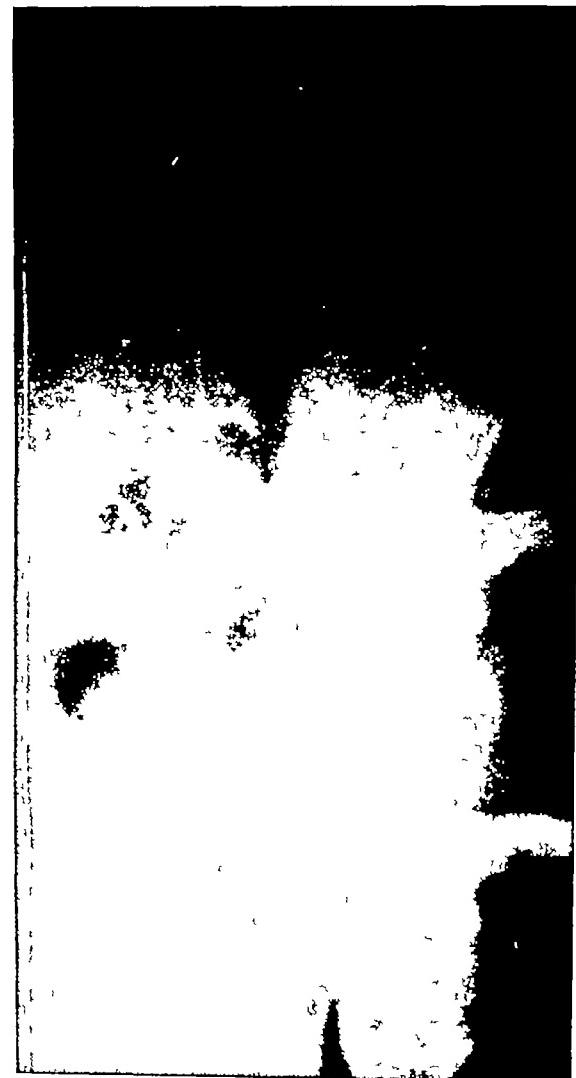


Fig. 4 The catheter in this film has been withdrawn into the upper ureter and the point of narrowing is very readily seen at the ureteropelvic sphincter.

Had a catheter been inserted no farther than this and injection of pyelographic medium begun, one of two things would have happened: either the fluid would have returned alongside the catheter, or, if the catheter was of sufficient caliber to occlude the ureter, then dilatation of the ureteropelvic sphincter would have resulted in rather marked renal discomfort and spasm.

Films reproduced in Figures 3-B and 4 were made with the fluoroscopic tube, having the cassette on the anterior surface of the body without the Bucky diaphragm.

which surrounds the kidney, and is quite distinct from the fibrous capsule of the kidney which closely invests the organ and lines the renal sinus. This is sometimes also called the *fascia renalis*, *fascia propria*,



Fig 3-B After the renal pelvis is well visualized fluoroscopically the catheter is withdrawn to just outside the ureteropelvic sphincter and films are made with the fluoroscopic tube, without the Bucky diaphragm. In almost all instances a much clearer outline of the pelvis is thus obtained for permanent records than with the usual procedure on a larger film with the Bucky.

the peritoneum passes from the liver to the anterior surface of the kidney, the lower third of the kidney is not covered by peritoneum. The area of the left kidney covered by the peritoneum is far less than that of the right kidney.

The upper third of the left kidney is related to the stomach, while the pancreas crosses its middle third, the lower third is covered by peritoneum and related to coils of small gut, the outer border being related to the spleen above and the colon below.

The upper two-thirds of the right kidney is covered by the under surface of the liver, the lower third by the hepatic flexure of the colon. The inner border is related to the duodenum.



Fig 3-A The tip of the ureteral catheter in correct position within the renal pelvis. With catheter thus placed, slow injection of pyelographic medium results in no spasm of discomfort to the patient, neither is there an over-distention, with resultant spasm, whereas, the entire filling is readily seen fluoroscopically.

The posterior surfaces of the ascending and descending colon are not covered by peritoneum, and hence the gut comes into relation with the perirenal fascia. The suprarenal gland rests upon the upper pole of the kidney, while posteriorly the kidney lies upon the quadratus lumborum and psoas muscles, the diaphragm, and the transversalis aponeurosis.

If the lumbar regions be examined from behind, it will be seen there is a difference in outline in the two sexes. In the female, the lumbar region broadens out below and

the vertebrae in front of the origin of the psoas muscle. The anterior layer merges with connective tissue elements at the root of the mesentery and around the great vessels. This layer does not extend beyond that point.

already described. At the level of the hilum they are kept apart by the renal vessels, while below, the ureter lies between them as it passes down to the pelvis.

At the outer border of the kidney, the



Figs 7 and 8. Bilateral pyelo-ureterograms in the prone and vertical postures, showing a rather decided loop in the upper ureter in the upright posture, and quite a decided angulation in a similar position in the prone posture.

These deformities in the ureteral outline were found to be due to an aberrant artery to the lower pole of the kidney.

In this case there is a very definite renal stasis and interference of emptying of the renal pelvis, especially in the upright posture.

to cross the midline to the opposite side. Above the hilum these two layers come together at the inner border of the kidney, being separated only by a deposit of fat, the posterior layer then becomes attached to the spinal column and the anterior ends as

two layers of fascia come together and join each other, forming a well marked band which passes out behind the peritoneum to join with the transversalis fascia. It forms an important means of fixation of the kidney. Other accounts of the arrangement of the

tunica fibrosa, capsule of Kustner or Zuckerkandl and consists of a thin sheath of fascia which completely surrounds the kidney and suprarenal body. The sheath is separated from the kidney by a layer of fat

lies between the peritoneum and the anterior surface of the kidney. Where it comes into relation with the peritoneum the two layers are closely blended together, where, however, the peritoneum is absent, it is related

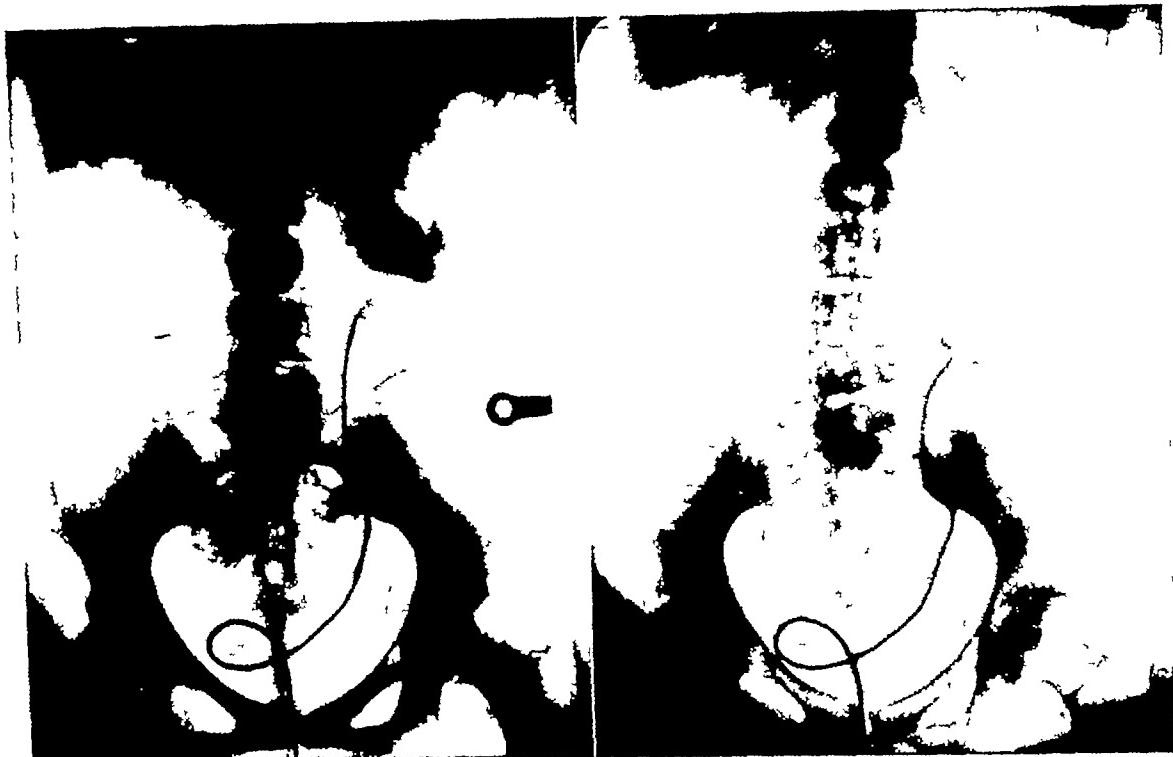


Figs 5 and 6 Pyelo-ureterograms in the prone and vertical positions
Note the ureteropelvic sphincter in the prone position, and the angulation in
the ureter just below the ureteropelvic junction
In the vertical posture, however, this was not sufficient to interfere with nor-
mal emptying of the renal pelvis while the patient was standing

within which the kidney is embedded and consists of two layers, an anterior and a posterior layer

The anterior perirenal layer, or fascia of Toldt, is a thin, fibrous membrane which

to the neighboring viscera the posterior layer or fascia overlying the lumbar muscles At the inner border of the kidney this layer reaches to the vertebral column and becomes firmly attached to the bodies of



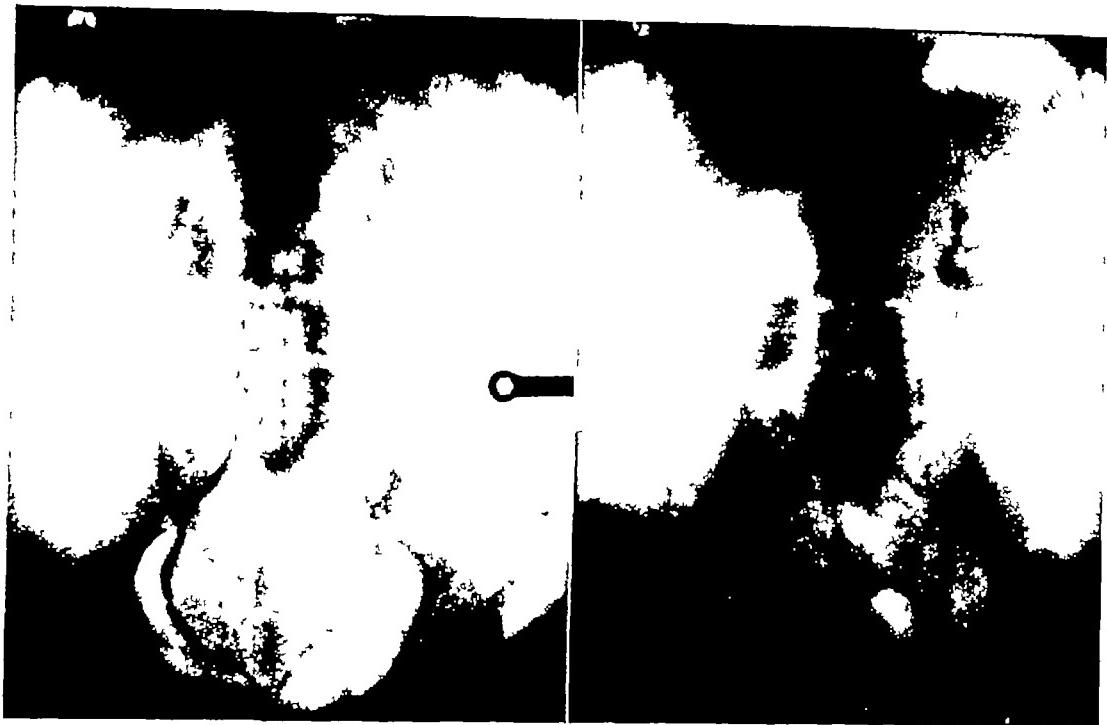
Figs 11 and 12 Left pyelograms in the prone and vertical positions showing a large hydronephrosis, the hydronephrotic sack not being clearly outlined in these films. However, there was a very decided retention, with little or no infection. At operation an aberrant vessel was found in the lower pole of the kidney, after this was severed, the renal pelvis readily emptied.

that showed that in the female the kidney has a greater range of movement, this has been considered as due to the shape of the renal fossa in this sex. On deep inspiration and expiration the renal pelvis rises or falls to the same extent as the diaphragm. In patients with enteroptosis the amount of displacement is increased and the degree of nephroptosis is readily detected. The right kidney moves more freely than the left, probably because the movements of the diaphragm are more directly transmitted to it through the liver, which descends into the renal pouch with each inspiration.

The movable kidney may be described as one which moves with abnormal freedom behind the peritoneum. The earliest reference in medical literature on the subject of movable kidney is found in the writings of Meuse, of Venice, who wrote a chapter on this subject in 1497, of Francis Pedemontanus, in 1581, and of Riolan, in 1682. Rio-

lan observed that the normal condition of the kidney is a fixed one in the flank, but that under certain conditions it becomes movable, and that stones or growths in the kidney especially favor the loosening. Rayner, in 1846, in his work "Diseases of the Kidney," reported seven cases of mobile kidney, which he thoroughly studied, not only from the anatomic but from the clinical standpoints of diagnosis, symptomatology, and treatment. He noted that the conditions were commoner in females than in males, and that it affected more frequently the right kidney. He also noted that pregnancy and heavy lifting were contributory causes, and that patients were usually thin and hypochondriac. Finally he stated that in some cases bandages gave relief. In 1864, Dietl described the crises found in certain cases of mobile kidney and gave to the literature the term "Dietl's crisis."

The first operation performed for mov-

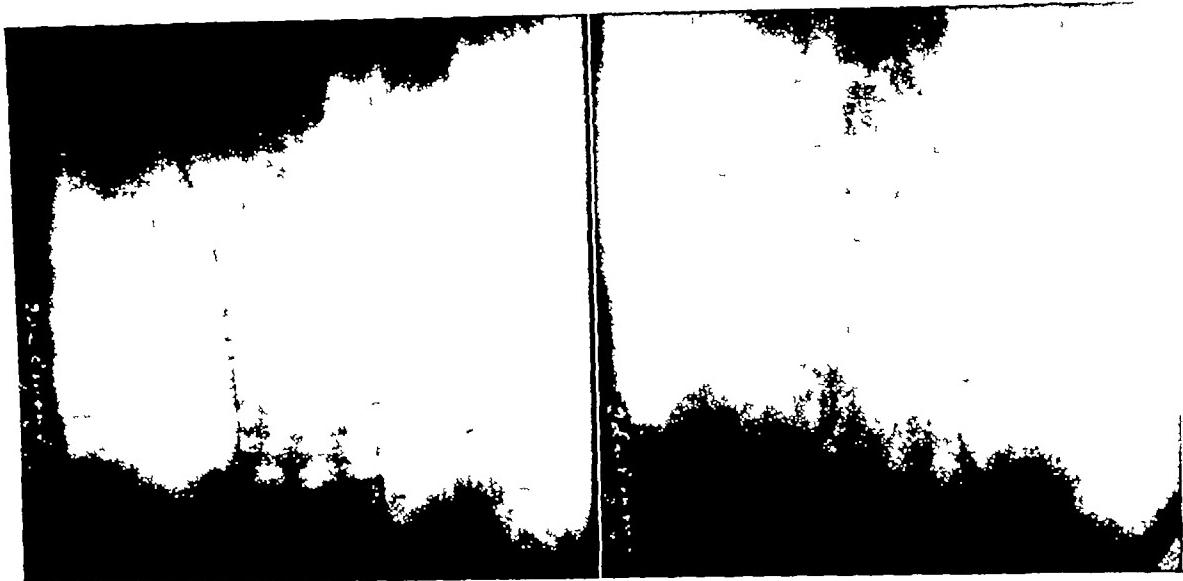


Figs 9 and 10 Bilateral pyclo-ureterograms, prone and vertical positions, revealing a very decided retention in the right renal pelvis, accompanied by infection. At operation an aberrant vessel was found in the lower pole of the kidney, crossing the ureter in its upper third in such a way that, after the vessel was severed, the pelvis readily emptied.

fascia at the outer border of the kidney are singularly incomplete. Cunningham states that the walls of the sheath come in contact and are connected with the retroperitoneal tissue. Thomson Walker merely states that the perirenal fascia appears between the transversalis fascia and the peritoneum and divides into two layers, while Kelly and Burnham find the two layers unite at varying distances and then pass forward under the peritoneum. Sir Henry Morris says it ends indistinguishably in the subperitoneal fascia, and Poirier states that the fascia is closed at the outer side, mentioning no specific attachments.

The anterior and posterior layers, after enclosing the kidney and suprarenal body in one compartment, join together at the upper pole of the suprarenal and pass up as a single strong band to unite with the tendinous area of the diaphragm. There is thus formed a strong suspensory band for the kidney when

the body is in the erect posture. The suprarenal is attached to the upper pole of the kidney by fibrous strands. The third support of the kidneys is the pressure exerted by the abdominal viscera, the fourth, the muscular tone and development of the abdominal walls, fifth, the nephrocolic ligament, and sixth, the kidney pedicle. The accessory factors such as the phrenocolic, hepatorenal, the duodenorenal ligaments, as well as adhesions between the spleen and kidney, deserve mention. The kidney normally moves during respiration, rising and falling with the action of the diaphragm. Earlier writers thought the kidney was a fixed organ, but Glenard, in 1899, showed that the organ moves with respiration. Kelly and Burnham state that the normal up-and-down movement during respiration varies from one to five centimeters, Thomson Walker observes the excursion varies from one-half to one and one-half inches. Rosen-



Figs 15 and 16 Bilateral pyelograms in the prone and vertical postures, made with the fluoroscopic tube on 10×12 films, without the Bucky diaphragm, which gave a clear visualization of the higher urinary tract. These can easily be made during the course of fluoroscopic study. Although there is a pronounced right renal ptosis in this instance, the pelvis was found to empty normally, there being no stasis or infection. This type of case is greatly relieved by the wearing of an abdominal support.

up to a comparatively recent date, the diagnosis depended largely on palpation and percussion, X-ray examination of the gastrointestinal tract, and observations of various surgeons when operating within the peritoneum. As a result a long list of symptoms as well as diseases has been attributed to ptosed kidneys, with resultant urinary stasis.

Bailey (2) states "The kidney pelvis, with its subdivisions, the calices and the ureter, constitutes the main excretory duct of the kidney. Their wall consists of three coats—an inner mucous, a middle muscular, and an outer fibrous."

The mucosa is lined by epithelium of the transitional type. There are from four to eight layers of cells, the cell outlines are usually well defined, and the surface cells, instead of being distinctly squamous, are only slightly flattened. Less commonly, large, flat, plate-like cells, each containing several nuclei, are present. Diffuse lymphatic tissue frequently occurs in the stroma especially of the pelvis. Occasionally the lymphatic tissue takes the form of small

nodules. Mucous tissue takes the form of small nodules. Mucous glands in small numbers are found in the stroma of the pelvis and upper part of the ureter. There is no distinct submucosa, although the outer part of the stroma is sometimes referred to as such.

The muscularis consists of an inner longitudinal and an outer circular layer. In the lower part of the ureter a discontinuous outer longitudinal layer is added.

The fibrosa consists of loosely arranged connective tissue, containing many large blood vessels. It is not sharply limited externally, but blends with the connective tissue of surrounding structures, serving to attach the ureter to the latter.

The larger blood vessels run in the fibrous coat. From these, branches pierce the muscle layer, give rise to a capillary network among the muscle cells, and then pass to the mucosa, in the stroma of which they break up into a rich network of capillaries. The veins follow the arteries.

The lymphatics follow the blood vessels,



Figs 13 and 14. Bilateral pyelo-ureterograms in the prone and vertical positions showing bilateral pelvic stasis and at operation an aberrant vessel in the lower pole of each kidney was found. This is the only situation I have observed in which aberrant lower polar vessels were bilateral.

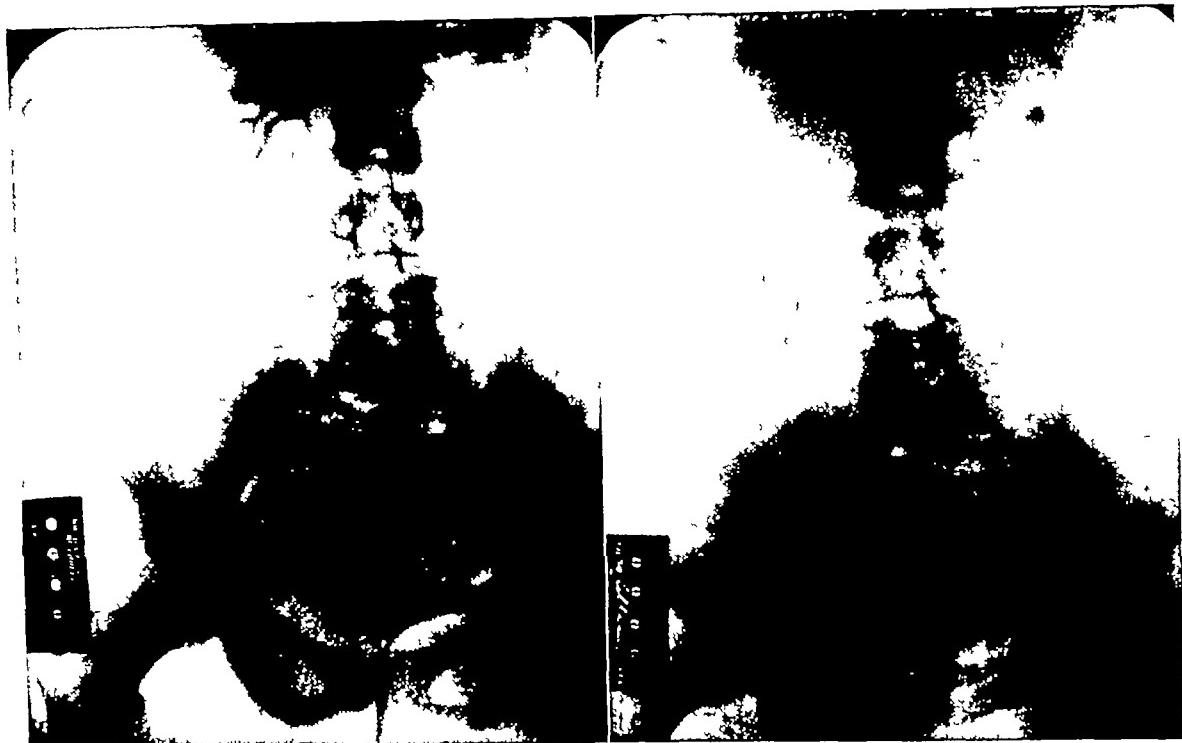
able kidney was by Martin, of Berlin, in 1878, when he carried out nephrectomy in two cases. Suspension of the organ was first carried out by Hahn, of Berlin, in 1881. His lead has been followed by many operators, and a vast number of operations have been devised to secure fixation of the kidney. Glenard, in his writings in 1885 and 1900 maintained that movable kidney was not a condition in itself, but part of a general enteroptosis, due to congenital weakness of the supporting structures of the abdominal viscera. Landau, in 1881, had maintained that the kidney was normally fixed and any degree of mobility was abnormal. This we now know is not true, as the organ moves with respiration.

More recently Fita, Dell, Treves, Goelet, Suckling Billington, Newman, Edebohls,

and Lane have added to the literature on this subject, while Sir Henry Morris and Sir William Roberts have contributed valuable additions to our knowledge. Up to 1901, Sir Henry Morris had performed 98 nephropexies with one fatal result.

Sappey and Zuckerkandl, in 1883, described a thickening of the connective tissue on the posterior surface of the fat capsule of the kidney, which he called the fascia retrorenal. Gerota, in 1895, described a layer on the anterior surface, which he called the fascia perirenal. The fascia is more marked on the left side, and this fact was first demonstrated by Toldt. Apart from this, little original work on the fascial attachments of the kidney appears to have been done.

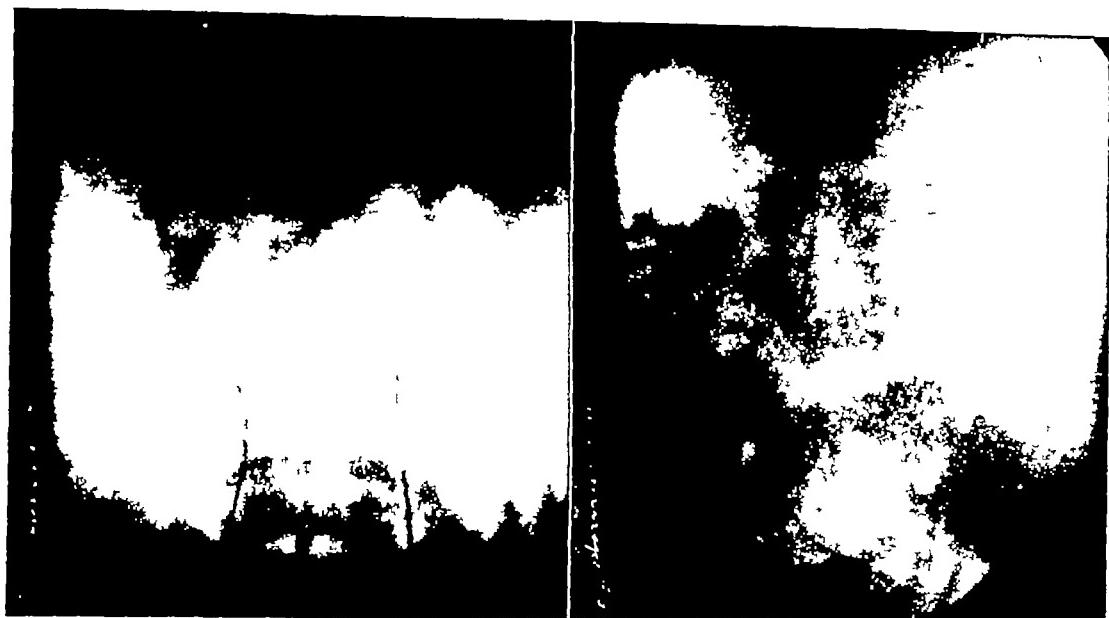
In all writings on motility of the kidney



Figs 19 and 20 Right pyelo-ureterogram in the prone and vertical postures reveals a normal appearing ureter and renal pelvis in the prone position, however, in the vertical position there is a very decided ptosis. This situation is one frequently encountered in patients who have persistent right abdominal discomfort, for which many have a "chronic appendix" removed.



Figs 21 and 22 Left pyelo-ureterogram showing a rather decided dilatation of the renal pelvis and irregularity of the minor and major calices, suggestive of acid-fast infection. However, there is no abdominal ptosis and the ureteropelvic sphincter and upper ureter show nothing to account for the pelvic dilatation.



Figs 17 and 18. Bilateral pyelo-ureterograms made with the fluoroscopic tube, without the Bucky diaphragm, in the prone and vertical postures, showing a bilateral ptosis with bilateral stasis and bilateral pyelitis.

In this case, as well as the preceding one, with the patient in the vertical posture, the palpating hand on the abdomen could easily replace these kidneys to normal position while being observed fluoroscopically, however, without this aid there was definite stasis present.

being especially numerous in the stroma of the mucosa

Nerves—Plexuses of both medullated and non-medullated fibers occur in the walls of the ureter and pelvis. The non-medullated fibers pass mainly to the cells of the muscularis. Medullated fibers enter the mucosa when they lose their medullary sheaths. Terminals of these fibers have been traced to the lining epithelium.

Bearing in mind the histologic and anatomic data, it is much easier to consider the subject of pyeloscopy because by this procedure we actually see the motion and physiologic phenomenon of the emptying of the renal pelvis and are brought to realize that the normal renal pelvis and ureter undergo very definite rhythmic contractions and dilatations, whereas many variations are encountered and observed in the abnormal.

It really is surprising how little has been written and how little description given of the physiologic action of the renal pelvis.

and ureter, even though the anatomic and histologic structure is well known. As an example of the text-book teaching, Stewart (3) states the following "Trickling along the collecting tubules, the urine reaches the pelvis of the kidney, from which it is propelled along the ureters by peristaltic contractions of their walls and drops from their valve-like orifices into the bladder."

Muschat (4) presents data which demonstrate rhythmic contraction of the spiral muscle of the renal papilla. It seems highly probable that this muscle causes an act of suction on the papillary duct, which milks the renal papilla. The force of the contraction varies for each preparation, but the time relation for contraction remains the same about every thirty seconds.

Young (5) says "The urine passes along through the ureter from the kidney as the result of peristaltic waves which originate in the musculature of the pelvis, and extend to the ureterovesical orifice."



Fig 26 Right pyelo-ureterogram made during the latter months of pregnancy because of severe, persistent hematuria



Fig 27 The patient shown in Figure 26 refused surgical interference and two years later returned for observation and this megaloureter was seen fluoroscopically to fill. However, pyelographic medium could not be introduced into the renal pelvis

at intervals varying from six to twenty seconds

"The renal pelvis and the uppermost part of the ureter show contractions of another type, namely, small oscillations which recur much more frequently than the larger contractions

"Chloroform and ether affect profoundly the large contractions of the ureter, so as even to abolish them completely, while the smaller oscillations show a greater resistance towards anesthetics"

The clinical value and practical application of the physiologic function and activities of the renal pelvis have been called to our attention by two clinicians, one a roentgenologist in this country, Manges, and the other a urologist in Paris Legueu

The fluoroscopic visualization of the higher urinary tract is now a practical procedure. The roentgenologist of to-day not only reports the findings as protracted by the pyelograms of the renal pelvis and ureter, but he also includes his fluoroscopic observa-

tion as he does a study of the gastro-intestinal tract

We are indebted to Manges (8) for demonstrating and calling to our attention the advantages of pyeloscopy combined with pyelography, and to him credit should be given for having coined the term "pyeloscopy," for, as he states "Pyeloscopy is but a preliminary to pyelography, and adds distinctly to the comfort of the patient, as well as the safety and the accuracy of the entire procedure." Seventeen years later, he added "That is just as apt and fair a statement of reason for advocating the method to-day as it was then." Pyeloscopy, then, is indicated in every, and not only in the exceptional or selected, case.

In 1911, Manges (9) began to study the urinary tract by means of pyeloscopy as an aid to pyelography, and to date has never allowed the making of pyelographic films



Fig. 23 Right pyelogram made during the later months of pregnancy, showing a marked dilatation of the upper one-half of the ureter and renal pelvis

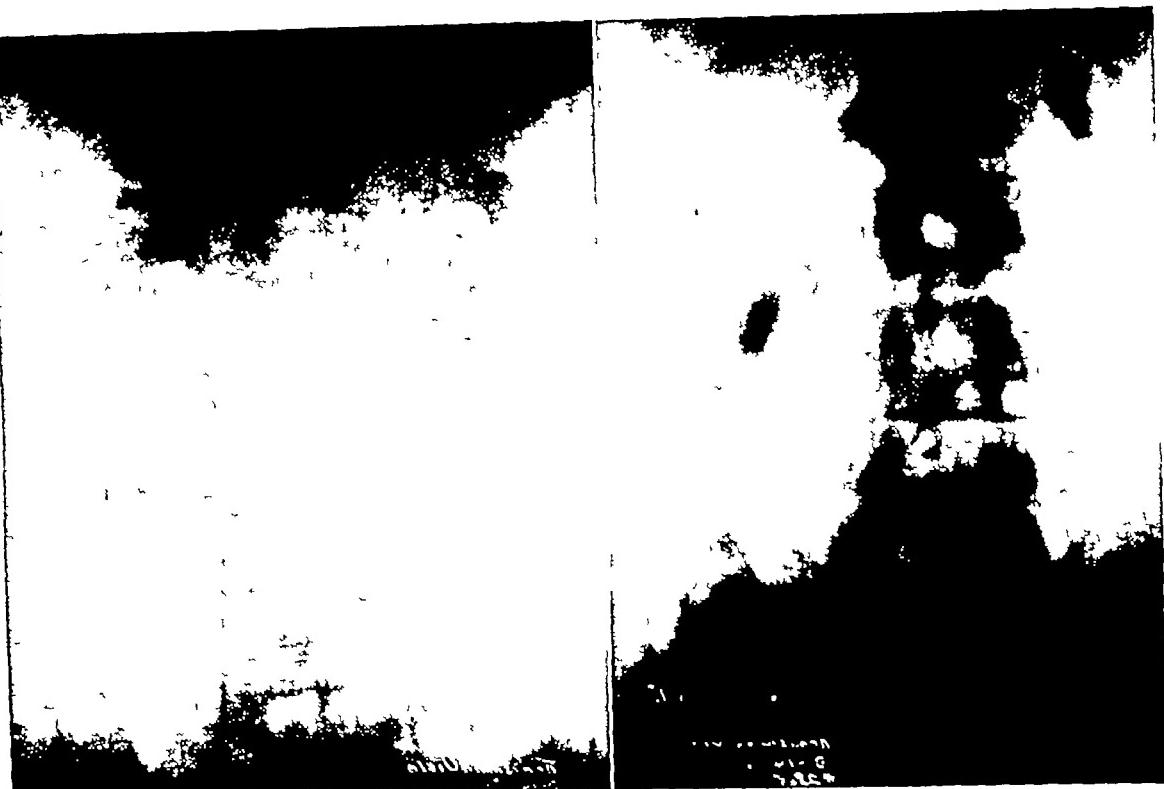
Our present knowledge of the movements of the ureter dates back to the classic studies of Engelmann (6), published about sixty-two years ago. His careful studies were made by simple ocular observation of the movements of the ureter in the dog, cat, rabbit, and rat. Engelmann made the statement that in the dog the movements might be studied by the graphic method, he, however, did not carry out such experiments.

Lucas made a rather exhaustive study of the physiology and pharmacology of the ureter in the dog by the graphic method. The essential points of his study of the ureter of dogs by the graphic method, he summarized as follows:

"Even under morphin anesthesia the middle part of the ureter (comprising at least two-thirds) shows comparatively large contractions which recur, if the urine is permitted to flow unimpeded into the bladder



Figs. 24 and 25 Right pyelogram of the same patient as shown in Figure 23, made 7 months after delivery, showing some dilatation in the upper third of the ureter and some dilatation of the renal pelvis. The upright posture shows a very marked ptosis. This is a very common finding in puerperal pyelitis.



Figs 30 and 31. Bilateral pyelo-ureterograms in the prone and vertical postures show a rather decided right renal ptosis. Fluoroscopy revealed a definite stasis.

This girl has had several major abdominal operations, none of which has relieved the right abdominal discomfort. An abdominal support was worn for some time without relief, and nephropexy was advised.

ing a five-inch film band for a unilateral study and a ten- to twelve-inch film band for a bilateral study.

As stated by Jarre (12), "The purpose of this presentation is to stimulate interest in those physiologic problems which concern medical roentgenology, with the expectation that we may derive therefrom a better conception of organic and functional normalcy and disease, and thus may improve roentgenologic diagnosis."

"Two groups of phenomena lend themselves to physiologic roentgenologic investigation (1) Those of motion which can be rendered radiovisible, and (2) phenomena of concentration and secretion of opaque substance as they are classically demonstrated by cholecystography."

"Whenever a tubular viscous is rendered radiovisible, one should study its function as well as its anatomic structure, since the eval-

uation of its physiologic behavior must be considered as equally important as—possibly even superior to—anatomic information. The omission of such observation will be regarded as negligence in medical practice of the future."

Having considered somewhat at length the anatomy, histology, and physiology of the upper urinary tract, one can now proceed with the factors pertaining to renal or ureteral stasis and the means of diagnosis at hand.

The first requisite is suitable equipment for roentgenologic study, and the table (13) which I have found most satisfactory is a motor-driven, tilt table, with the Bucky travelling the full length of the table and the fluoroscopic screen movable over the upper two-thirds.

Cystoscopy and ureteral catheterization may be carried out on the X-ray table, or



Figs 28 and 29 Bilateral pyelo-ureterograms in the prone and vertical postures showed a bifurcation of the right ureter with two pelvis on the right side.

There is some dilatation and definite clubbing of the minor calices of all three pelvis in the prone position, however, in the vertical posture, the minor calices in the superior pelvis on the right side, which were before very much blunted, are now normally cupped.

without fluoroscopic control and study as the injection is being made into the ureter or renal pelvis

If one is to determine the degree and amount of renal stasis, this can be satisfactorily accomplished only by the aid of the fluoroscope before making pyelo-ureterograms. The interpretation, therefore, largely rests with the roentgenologist and from his reports, plus the clinical evidence and the urologic findings, the urologist is able to draw a much more satisfactory conclusion with regard to treatment and further procedure.

In spite of the fact that pyeloscopy has been practised by Manges for the past twenty years, and his technic described in various journals, the roentgenologist has been slow to provide adequate equipment to carry out this procedure, with the result that pyeloscopy is made very little use of in this country.

In the past three years, the urologist has had the advantages of pyeloscopy most forcibly brought to his attention by the work of Legueu (10) in whose monograph the physiologic action of the renal pelvis and ureter is very strikingly presented. All of this one can easily see for himself, when fluoroscopic studies are made of the renal pelvis. Once having visualized the higher urinary tract, one would never be satisfied to continue the old method—working in the dark and not knowing where the ureteral catheters were, the presence or absence of stone, when the renal pelvis has enough solution for good films without over-distention of the pelvis, and resultant pain to the patient.

The very recent, original, and valuable contribution of Jarre and Cumming (11) has added to our knowledge immensely. Their appreciation of motor function and physiologic action of the renal pelvis and ureter was recorded by a Cinex camera, us-



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Cystoscopy and ureteral catheterization may be carried out on the X-ray table, or

the patient may be cystoscoped and then placed upon the X-ray table. With the Bucky at the foot of the table, the fluoroscopic screen is brought into place over the abdomen, the ureteral catheters located and note made of their position, relation to opaque bodies such as calculi, and the relative position in the renal pelvis.

The medium used heretofore for visualization of the renal pelvis and ureters has been sodium iodide 12 per cent, 20 per cent, or 30 per cent. However, as this solution is more or less irritating to certain individuals recently, use has been made of uroselectan or skiodan for injecting into the renal pelvis. These are practically non-irritating to the mucosa of the renal pelvis, ureter and bladder. Then 0.5 cc. of solution is injected through the catheter, this amount being sufficient to locate the tip of the catheter and its relation to the renal pelvis, whether it is below the ureteropelvic sphincter, within the pelvis proper, or in one of the major calices. Severe pain may follow the injection of a greater amount of fluid if the catheter tip is below the ureteropelvic sphincter or if the tip of the catheter is within one of the major calices and a sudden over-distention of that particular calyx takes place.

Often the entire renal pelvis is clearly outlined, especially if one of the more concentrated solutions is used, upon the injection of only 0.5 cubic centimeter. Up to this time there has been no pelvic spasm with resultant discomfort. After the initial injection of one-half cc., 1 cc. at a time is added until the entire pelvis is clearly outlined. At this time 10×12 films are made, using the fluoroscopic tube and placing the cassette under the fluoroscopic screen in the holder designed for this purpose, without a Bucky diaphragm. As a rule a more clear-cut image of the pelvis is thus obtained than when 14×17 films of the entire genito-urinary tract are taken with the Bucky.

During this part of the examination the degree of respiratory excursion of the kid-

ney is noted and the patient is then placed in the erect posture and the actual amount of excursion from the prone to the vertical position is observed.

It will be noted that many renal pelvis readily empty even though there is an abnormal amount of motility with resultant tortuosity of the ureter. In the erect posture, should there be a delay in the emptying of the renal pelvis, by means of counter-pressure with the hand of the operator on the abdomen the kidney can easily be elevated and then one sees the normal process of emptying continued.

In another instance there may be little or no appreciable excursion of the kidney, and yet in the erect posture there is a delay in emptying. This may be due to fixation of the upper ureter and even so little downward descent of the kidney is ample to prevent normal emptying with resultant stasis of varying degrees.

I am of the opinion that the respiratory excursion of the kidney in the prone position is not a true index of the condition in the erect posture, and I also am convinced of the advisability and necessity of palpation of the kidney in both the prone and vertical positions while making routine physical examination before it is concluded that the kidney is not palpable or tender or that fist percussion reveals no tenderness in the renal region.

Having noted the renal motility in the erect posture, the next problems to decide are (A) Is there any retention or interference with the normal emptying of the renal pelvis while in the erect posture? (B) Does the renal pelvis normally contract and relax when the kidney is elevated by the hand of the operator? (C) Is the kidney fixed or rotated so that stasis results? These questions can most satisfactorily be settled only with a table that places the patient in the standing position. I do not believe that the sitting posture with the thighs flexed will

give as true a degree of motility and resultant dysfunction as the standing position

By this means we then have a correct conception of the physiologic function of the renal pelvis, and are enabled to say, with some degree of accuracy, which patient should be subjected to nephropexy, which will be benefited by the proper kind of abdominal support (as we see many kidneys that come well down to the crest of the ilium or below), and which function properly and have no stasis when elevated to their normal position

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EAR COMPLICATIONS IN ACUTE CRANIOCEREBRAL INJURIES

A STUDY OF 476 CASES

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EAR complications are frequent in cases of skull fracture with brain injury. In a series of over 2,600 cases seen at the Receiving Hospital, Detroit, within a period of five years (1925-1929), there were 476 cases with bleeding or cerebrospinal fluid leakage from either or both ears. The accompanying tabulation (Table I) shows that the left ear is more frequently involved and that with unilateral bleeding the mortality is approximately 38 per cent. With bilateral discharge, the mortality rises to 67 per cent. These figures are astonishingly similar to those reported by Davis (1). However, unlike his experience in cases with cerebrospinal fluid leakage from the ear, the results in this clinic have been much better, the mortality being near 50 per cent. It is undoubtedly true that a certain number of cases with cerebrospinal fluid leakage are not diagnosed because of the presence of blood in the discharge and because, in the majority, the discharge stops very soon after the accident. It should be remembered that there may be bleeding into the tympanic cavity with no associated rupture of the membrane. In such cases, the blood may show in the nasopharynx, escaping the middle ear through the eustachian tube. Bleeding from the ear does not always imply fracture through the petrous bone. There may be a rupture of the membrane caused merely by pressure changes with consequent bulging or retraction of the membrane during the accident. However, as will be brought out later, bloody discharge from the ear is in the majority of cases associated with a fracture somewhere in the skull. In our experience the bleeding usually stops within a few hours after the accident. Occasionally one sees persistent bleed-

ing for several days. In some cases with profuse bleeding the possibility of lateral sinus, jugular bulb, or middle meningeal artery rupture into the middle ear should be kept in mind. In a series of 1,000 cases of skull fracture, Besley (2) found 316 cases with aural bleeding. This is in excess of our findings, but his ratio between left-sided and right-sided involvement compares favorably with ours.

The complications of bloody or cerebrospinal discharge from the ear are otitis media, mastoiditis, and meningitis. In this series there were four cases of meningitis, otitis media occurred nine times, and mastoid infection was present in three cases.

Mastoiditis is a rare complication of skull fracture. While only a limited number of cases have been reported in the literature (see below), probably more would be diagnosed if the possibility of this infection were kept in mind. X-ray examination of the mastoid region is particularly helpful in arriving at a conclusion. It is undoubtedly true that some of the milder cases improve without operative intervention. Because reports of mastoiditis following skull fracture are rare in the literature, the history and the physical findings of our three cases will be given in some detail.

Case 1. Skull fracture following an automobile accident, with bleeding from the right ear, otitis media, and mastoiditis. Operation performed, with recovery.

E H (E-5511), age 24 years, was brought to Receiving Hospital in a semicomatose state, exhibiting bleeding from the right ear. Physical examination showed that the pupils fundi, and extra-ocular movements were normal. There were no cranial nerve palsies. Reflexes were present

throughout Blood pressure was 130/70 The heart, lungs, and abdomen were negative

During her stay in the hospital, the right ear drained continuously, and toward the eighth day the discharge became mucopurulent in character At the same time, the patient developed pain behind the right ear X-ray examination gave evidence of mastoiditis After a week of conservative treatment the patient was operated on A fracture line was found extending across the mastoid region toward the occipital bone, with much purulent material in the mastoid cells The region was curetted out in the usual manner, the dura and the sinus region being exposed during the operation The patient made an uneventful recovery

Comment—The fracture in this case undoubtedly extended into the middle ear, and extension of the middle ear infection into the mastoid cells was much facilitated by the presence of the bony crack uniting those two spaces

Case 2 Skull fracture following an automobile accident, with bleeding from the left ear, otitis media, and mastoiditis Recovery ensued, conservative treatment

A H (E-3479), age 25 years, entered the Receiving Hospital on March 20, 1927, following the accident On entrance she was in a dazed condition, and was unconscious for about an hour There was bleeding from the left ear The neurologic examination was essentially negative, except for the subjective symptoms of headache and drowsiness During her stay in the hospital, the patient's temperature remained normal, but on March 20 there was much pain in the left ear followed by seropurulent discharge X-ray examination of the mastoid region two days later showed definite cloudiness on the left side with moderate destruction (second degree) of the air cells The pain in the ear and the mastoid tenderness subsided the patient's temperature remaining normal throughout It was thought advisable to

treat her conservatively She remained in the hospital for 27 days, with complete recovery

Comment—Here again we have a patient who developed otitis media following bleeding from the ear There was definite mastoid tenderness with positive X-ray evidence of mastoiditis, however, it was justly thought advisable to treat her conservatively because the clinical course was one of gradual improvement

Case 3 Fracture in the mastoid region, following an automobile accident There was no bleeding from the ear, but simultaneous otitis media, mastoiditis, and meningitis Mastoidectomy was performed, followed by death

L C (D-13055), age 6 years, entered the Receiving Hospital following an automobile accident On entrance he was drowsy and had several attacks of projectile vomiting Physical examination showed an abrasion in the right temporal region, the right pupil was larger than the left, but there was no external evidence of bleeding from the ears X-ray examination showed a fracture in the mastoid region on the right side, extending toward the lambdoid suture

During his stay in the hospital the child complained of pain in the right ear, at the same time he exhibited rigidity of the neck Spinal puncture at first showed clear fluid, but later it was purulent The right ear drum was incised with escape of mucopurulent material Mastoidectomy was performed, disclosing this region to be filled with purulent material and showing much destruction of mastoid cells There was daily drainage of spinal fluid During the course of events the patient's temperature rose to 105 degrees F and there was accentuation of the meningeal symptoms, and just before death, which occurred Nov 19, 1926, the temperature was 109½ degrees rectally

Comment—In this case the fracture in the mastoid region was followed by infec-

TABLE I.—ANALYSIS OF 476 CASES OF BLEEDING FROM THE EAR (UNILATERAL, BILATERAL, CERBROSPINAL LEAKAGE)

| Right ear | Left ear | 205 cases | | 98 cases | | 98 cases | | 98 cases | | Complications | | X-ray findings | |
|-----------|----------|-----------|------|-----------|------|-----------|------|-----------|------|---------------------|--------------------|----------------|--|
| | | Recovered | Died | Recovered | Died | Recovered | Died | Recovered | Died | Unilateral Bleeding | Bilateral Bleeding | Not examined | |
| 173 cases | | 110 | 63 | 127 | 78 | 32 | 66 | 4 | 9 | Positive | Negative | 48 | |
| | | | | | | | | | | Positive | Negative | 1 | |
| | | | | | | | | | | Positive | Negative | 18 | |
| | | | | | | | | | | Positive | Negative | 49 | |
| | | | | | | | | | | Positive | Negative | 49 | |
| | | | | | | | | | | Positive | Negative | 48 | |

The meningitis was most probably secondary to the mastoid infection. Mastoidectomy was performed with a view to removing the focus of infection to the meninges, unfortunately this was of no help to the patient. Although there was no bleeding from the ear, hemorrhage in the middle ear without rupture of the membrane may have occurred.

The X-ray findings in the series are very interesting. In 379 cases with unilateral bleeding, 282 were examined by X-ray. A majority of the patients who were not subjected to X-ray examination either died a short time after admission or were too ill to sustain the added manipulations. A very small number, indeed, were not examined because of transference to another institution. In 98 cases with bilateral bleeding, 49 were examined by X-ray. Among those with unilateral discharge 93 per cent gave positive evidence of skull fracture, among those with bilateral bleeding, 98 per cent.

At the Receiving Hospital every case of possible skull fracture is examined by X-ray within 12 hours after admission, with the exception of those who are too ill. Routinely, anterior, one base, and two lateral exposures are made in every case. The base exposure brings out particularly the occipital region and the *foramen magnum*. Dr J. C. Kenning, the roentgenologist, insists on as rapid technic as possible, since these patients are in varying degrees of shock, and it is difficult to immobilize their heads for the longer exposure necessary with the Bucky, at least in the majority of the cases. This rapid technic of four views gives very excellent detail of the skull. It is important to focus on the region in which the fracture is suspected, for improper focusing will obliterate fine linear fractures by lapping. All questionable cases of fracture are re-examined, particularly if they show clinical signs of trauma. It is especially advantageous to use the usual mastoid views in some of the

TABLE II—SITE OF FRACTURE IN RELATION TO BLOODY DISCHARGE FROM THE
EAR (313 CASES)

These cases showed X-ray evidence of fracture

| Fracture in the anterior third of the skull | | | Fracture in the middle third of the skull | | | Fracture in the posterior third of the skull | | |
|---|-------------------|--------------------|---|-------------------|--------------------|--|-------------------|--------------------|
| Bleeding right ear | Bleeding left ear | Bilateral bleeding | Bleeding right ear | Bleeding left ear | Bilateral bleeding | Bleeding right ear | Bleeding left ear | Bilateral bleeding |
| 13 | 18 | 11 | 61 | 83 | 16 | 49 | 56 | 15 |

cases in which fractures in this region are suspected

With such a technic, over 95 per cent of the cases with aural bleeding were proved to have fracture somewhere in the skull, however, it is important to stress that a great many had fractures in distant parts. The most common roentgenologic finding with aural bleeding was a fracture line in the mastoid region extending toward the vertex or the occipital bone, this being true in fully 50 per cent of the cases. A great many had fractures in the parietal bone, extending down into the middle fossa. Others showed fractures in the region of the foramen magnum, probably extending forward toward the petrous bone. A certain number of the frontal sinus fractures exhibited aural bleeding. A few compound and depressed fractures were accompanied by bloody discharge from the ear, but fractures in the mastoid region predominated and constituted fully 50 per cent of the cases.

DISCUSSION

Thus it is seen that bleeding from the ear is a serious manifestation in craniocerebral injuries. The mortality is decidedly higher than the ratio of the total mortality of the entire series, which is around 25 per cent. The cerebral manifestations in cases with aural bleeding are more severe, however, it

is surprising to note that a certain number show very little derangement of brain function.

The X-ray findings in the series are commendable. Positive findings in cases with unilateral bleeding were 93 per cent, in bilateral, 98 per cent. It must be emphasized that aural bleeding does not always imply fracture in the region of the ear, at least roentgenologically. A great many in this group suffered fractures in other parts of the skull, and the aural bleeding was most probably merely a complication. However, it should be remembered that if a blow is severe enough to cause bleeding from the ear, in 93 per cent of the cases a fracture is found somewhere in the skull, with unilateral bleeding. In cases with bilateral bleeding, there is probably a greater percentage of petrous fractures. The most common roentgenologic finding in this series was a fracture in the mastoid region extending toward the vertex or the occipital bone.

The complications of bleeding from the ear are otitis media, mastoiditis, and meningitis. In the nine cases of middle ear infection seen in this group, the clinical picture presented itself after from a week to ten days. A certain number of these cases recovered with simple drainage. Three had added mastoid infection and one of the latter also developed meningitis. The reason for such a low incidence of otitis media in the

series is explained by the treatment they receive in this Hospital, *i.e.*, the ear is left alone, no irrigations are used, and the patients are not unnecessarily inspected. If there is profuse bleeding, the ear is not packed tightly. In craniocerebral injuries, a case of purulent otitis media is a potential case of mastoiditis. The patient's general condition, temperature, appearance of tenderness in the mastoid region are noted and, if necessary, an X-ray film of the mastoid is procured. Middle ear infection is serious, for meningitis may be one of its sequelæ, such as was true in Case 3, the patient also having a purulent mastoiditis. Although the meningeal symptoms were evident, mastoidectomy was performed in order to remove the focus of infection, but, as practically always is the case, this was of no help to the patient.

The incidence of meningitis in the series is 0.85 per cent. Compared with the incidence in the entire group of 2,600 cases, this complication is more frequent in patients with aural bleeding. Meningitis occurred 19 times in the entire group (0.73 per cent). Any operative approach to curb the appearance of this complication in craniocerebral injuries with aural bleeding or cerebrospinal fluid leakage from the ear seems to us rash surgery. A better approach would be medical preventive measures.

Mastoiditis following otitis media, due to aural bleeding in head injuries, has been described by several authors, and in their paper on this subject Miller and Lauppe (3) review the literature. They found 22 reported cases. Their patient showed the clinical evidence of mastoiditis fully three and one-half weeks after the accident. In this paper we have described three cases, one with co-existent meningitis and two uncomplicated cases. The latter two recovered. One was operated on and the other treated conservatively. The patient who died had a mastoidectomy performed, but he succumbed to the complicating meningitis. Al-

though it is a very rare complication in craniocerebral injuries, mastoid infection, particularly in the presence of otitis media, should be kept in mind. We dare say more cases would be diagnosed if this were remembered. The treatment is either conservative or operative, depending on the severity of the clinical manifestations.

A word should be said concerning complicating facial paralysis in cases of aural bleeding. This is not very common, and unfortunately our records on this point are not complete enough to give statistical data. In a more recent series, to be reported later, the incidence of peripheral facial palsy is around 11 per cent. It should be remembered that facial palsy in these patients may not be evident for a day or two, particularly if the patient is very ill. The bilateral difference in the tonicity of the orbicularis oculi, or a slightly open palpebral commissure on the side of the lesion, may give one the clue as to the presence of the condition. Of course, in the co-operative patient the diagnosis is very simple. The facial paralysis is most frequently a unilateral condition, although very rarely one sees a bilateral facial palsy in a case with bloody discharge from both ears, as was the case in one of our recent patients, a boy five years of age. Rarity of bilateral facial paralysis probably is due to the fact that most of the cases with bilateral bleeding die.

In the majority of the examined cases there was a sensory (taste) change in the anterior two-thirds of the tongue on the affected side. This is most probably caused by pressure against, and distortion of, the chorda tympani nerve as it traverses the middle ear. If it were due to a derangement of the geniculate ganglion region, more patients would show dysfunction of the vestibular system, because the vestibular nerve is in close proximity to the facial in this situation. In view of the fact that a majority recover within a few weeks, the pathogenesis is probably hemorrhage about and within

the facial canal, with pressure neuritis ensuing. In a large percentage of the surviving patients there are no associated vestibular signs of dysfunction, placing the lesion more peripherally than the internal acoustic meatus.

SUMMARY

Aural bleeding in cases of craniocerebral injury is a serious complication. The treatment is conservative both in cases with bleeding and cerebrospinal fluid discharge. The ear should be left alone if it has stopped bleeding. Unnecessary examination may cause the introduction of infection. In cases in which there is still some discharge, the external ear should be carefully cleansed, the wall of the external auditory canal painted with 4 per cent iodine solution, and a mastoid dressing applied either with no packing of the canal or with very loose packing. As long as the patient does not complain of ear ache and there are no unexplainable clinical manifestations, the less done to the patient, the better the results.

1 A total of 476 cases of aural bleeding or cerebrospinal fluid leakage from the ear are reported.

2 The right ear was involved in 36.5 per cent of the total group, the left ear, in 43.1 per cent, there was bilateral bleeding in 20.6 per cent of the cases.

3 In the group examined by X-ray, positive findings in cases with unilateral bleeding were 93 per cent, and in cases with bilateral bleeding, 98 per cent.

4 Otitis media was found in nine cases, meningitis in four, and mastoiditis in three.

5 The mortality was 37.1 per cent with right-sided, 38.5 per cent with left-sided, and 67.3 per cent with bilateral discharge.

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GASTRIC TUMORS¹

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APPROXIMATELY 10 per cent of the general run of patients consult a physician on account of gastric symptoms. A study of the causes of gastric complaints in our clinic showed that only 15 per cent of these patients had organic lesions in the stomach or duodenum to account for their symptoms.

Gastric tumors were found in 32 per cent of the total series. These tumors consisted of 111 gastric cancers, 3 benign tumors, 1 hair ball, and 2 cases of gastric syphilis, making an incidence of 1 benign gastric tumor to 39 malignant neoplasms. In a study of a large series of gastric tumors G. B. Eusterman states that in his experience gastric carcinoma is 200 times as frequent as benign tumor.

With the possible exception of the uterus, the stomach is affected by cancer more frequently than any other organ. Notwithstanding the relative frequency and the present accuracy of diagnosis of gastric cancer, this lesion is of such gravity that any series of cases is deserving of detailed study.

In reviewing the histories of a group of patients with gastric cancer, it is immediately apparent that during the past two decades the roentgen ray in the hands of experienced roentgenologists has contributed more to the advancement of the diagnosis of this condition than the combination of all other methods. Yet, owing to the nature of the lesion and the failure to suspect or recognize early signs of the disease, nearly two-thirds of the cases are inoperable at the time the diagnosis is made.

The two chief causes for failure to recog-

nize many early gastric cancers are the anatomic location of the growth and the more or less prevalent idea that the clinical signs of cancer of the stomach always manifest themselves by a sudden onset accompanied by absence of free hydrochloric acid, in a patient previously free of gastric disturbances. The first cause unfortunately cannot be remedied. The second cause can be reduced greatly by reviews of carefully obtained clinical histories of patients suffering from gastric carcinoma.

The location of a gastric cancer has a great deal to do with the early recognition of the growth. A review of our case histories showed that 50 per cent of the lesions began in the pyloric segment, 30 per cent in the middle third of the stomach, and 20 per cent in the upper third. In 80 per cent of the series, the cancer originated in a resectable portion of the stomach. A lesion situated at either orifice produces symptoms indicative of motor disturbances of the stomach much sooner than one located along the greater curvature. Early pyloric obstruction is a fortunate complication because it forces the patient to consult his physician, and vomiting of retained food is a danger sign recognized by even the most inexperienced. The majority of gastric cancers, practically all of which are capable of early demonstration by the roentgenologist, are situated in the pyloric segment or immediately adjacent to it, in an area where they often produce clinical signs, *suggestive*, at least, of the disease. Yet more than half of pyloric carcinomas are inoperable at the time they are diagnosed. Many persons, therefore, are deprived of their only chance of cure or prolongation of life by late diagnosis. Failure to recognize an operable carcinoma is a serious mistake.

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles Dec 1-5 1930

Carcinomas situated in the upper third of the stomach and not causing symptoms of dysphagia are easily overlooked unless the roentgenologist is constantly on his guard. When clinical signs suggest an intra-



Fig 1 Case 1 Artist's drawing showing the findings at the fluoroscopic examination. By palpating the partly filled stomach, three small tumors were clearly seen.

abdominal carcinoma, the necessity of careful examination of this portion of the stomach by the use of special technic and fluoroscopic and radiographic examination in various positions cannot be over-emphasized. Most errors in the roentgenologic diagnosis of gastric carcinoma are made in this region. However, malignant growths of the stomach which are difficult to visualize are as a rule inoperable. A question commonly asked the roentgenologist, after the diagnosis of a malignant tumor of the stomach, is whether or not the case under discussion is operable. Unfortunately there is no method by which the operability of a given case can be determined, owing chiefly to the fact that we cannot tell before operation the presence or extent of intra-abdominal metastasis, either peritoneal or in adjacent organs.

The roentgenologist is of great service to the surgeon in determining the approximate

extent of the growth, but there is no definite roentgenologic line of demarcation between the operable and the inoperable case. Surgeons now claim that the surgical accessibility of the growth has a great deal more to do with its removal than the size of the tumor. The general physical condition, the habitus of the patient, and the movability of the stomach are very important factors in determining the amount of the stomach which may be resected.

Not infrequently a patient with gastric cancer is deprived of an early diagnosis because the physician he first consults still believes that the gastric disturbances are not due to a cancer because there is a history of chronic dyspepsia and the analysis of gastric secretions shows the presence of free hydrochloric acid. It is a mistake to assume that gastric cancer always begins with a sudden onset in a patient previously free from trouble with the stomach. A patient presenting a history of chronic dyspepsia from any cause may at the moment be developing cancer, and he is just as deserving of a detailed study to determine or to rule out cancer as is one who consults a physician on account of comparatively recent development of gastric symptoms.

Recently² we made a study of one hundred cases of cancer of the stomach in which particular attention was paid to the onset and duration of gastric symptoms. The review showed that 62 per cent of the patients gave no history of gastric disturbances prior to the onset of the present complaint, and their increasing gastric symptoms averaged only eight months. Examination of these patients showed a large filling defect on the roentgenogram, and in only two instances was there even a trace of free hydrochloric acid. The smaller group, comprising 38 per cent of the series, presented a striking contrast in having a longer early

²M. F. Dwyer, J. M. Blackford, and H. C. Turner, Gastric Cancer, *Jour Am Med Assn*, Nov 9, 1929, **XCVIII**, 1456.



Fig 2 Case 1 Roentgenogram of the partly filled stomach, showing the filling defects produced by the tumors on the posterior wall of the stomach



Fig 3 Case 1 Roentgenogram showing the completely filled stomach. Only one small filling defect can now be noted

history of dyspepsia, averaging ten years before the onset of symptoms characteristic of cancer. These histories of chronic gastric disturbances suggested chronic cholecystitis, gastric ulcer, or the various functional dyspepsias. Gastric analysis was recorded in 31 of the 38 cases, 70 per cent of which showed free hydrochloric acid and occasionally even a hyperacidity. It was of interest to note that in those cases where the original site of the growth could be determined with reasonable accuracy, the group with histories of long-standing dyspepsia were found to have a much larger relative percentage of pyloric cancers than the group presenting short histories. Grave injustice is done a patient if a cancer of the stomach is overlooked simply because he gives a history of chronic indigestion, and free acid can be demonstrated in his gastric contents.

Benign tumors of the stomach are not common. In over five thousand examinations in our clinic, three cases of benign tumors and one gastric hair ball were encountered. While they are not of frequent occurrence, these benign neoplasms are of sufficient importance that the possibility of their presence must continually be borne in mind by both clinician and roentgenologist. A benign gastric tumor may be the cause of atypical gastro-intestinal complaint, and its finding and successful removal by an exploratory operation will recompense and justify a very grave pre-operative diagnosis of malignant disease.

The three cases of benign tumors here reported consist of one with five very vascular mucous polyps, one large fibromyoma, and one leiomyoma.

In reviewing these cases, one is impressed by the lack of gastric symptoms. With the

exception of repeated gastric hemorrhages in the case of the leiomyoma, there were no symptoms indicative of gastric diseases. Gastro-intestinal hemorrhage appears to be a relatively frequent finding in this class of case, however, the number of cases reported in the literature is too small to justify one in drawing conclusions as to the characteristic symptomatology of benign gastric tumors.

Briefly, benign tumors are classified as papillomas, myomas, adenomas, fibromas, lipomas, osteomas, cysts, and adenopapillomas, the presence of the last being commonly called polyposis.

CASE REPORTS

Case 1 A clergyman, aged 48, consulted us in July, 1927, complaining of repeated severe attacks of diarrhea over a period of twenty-five years. In 1903, the patient had had an attack of indefinite upper abdominal distress, associated with jaundice and fifteen or twenty bowel movements a day. The diarrhea was not painful and no blood was seen, but a considerable amount of mucus was passed. In 1924, the gall bladder was removed, and the patient states that, after this operation, his diarrhea was less until three months before consulting us. In 1926, he weighed 175 pounds. In May, 1927, another attack of diarrhea began. He was examined clinically and roentgenologically by his family physician, who found no trouble in his stomach. The diarrhea continued, and he then came to Seattle. On arriving at the Clinic, his condition was so critical that he was immediately placed in the hospital. He had lost 50 pounds in weight and was very emaciated. Laboratory examinations showed a marked secondary anemia, a hemoglobin of 65 per cent, and absence of free hydrochloric acid. Roentgenologic examination showed three small tumors in the upper third of the stomach.

posteriorly (Figs 1, 2, 3), and a diagnosis of benign tumors was made. Examination of the colon was negative. The patient was operated upon July 30, 1927. The stomach was opened by a midline incision and five polyps removed (Fig 4). Three of these had been detected on X-ray examination, one polyp about the size of a lemon and two about the size of a cherry. Each of the additional two found at operation was about the size of a cherry seed.

Pathologic examination showed each tumor to be a highly vascular mucous polyp, covered by a single layer of gastric mucosa. The underlying tissue was mucoid in character, similar to that seen in a nasal polyp.

This patient, whose progress has been closely followed, was last seen one month before the present report. He has been free from diarrhea since operation, a period of 40 months, has gained 45 pounds in weight, and states that he feels perfectly well.

Case 2 An Alaskan miner, aged 67, consulted a physician in October, 1926, on account of loss of 60 pounds in weight, weakness in his legs, and two severe attacks of diarrhea. A considerable amount of blood was passed during the second attack of diarrhea. During the attacks, he occasionally felt nauseated and vomited a few times. He stated that, with the exception of chronic constipation, he had always enjoyed good health prior to the onset of his present complaint. On examination of his blood, erythrocytes 3,130,000, leukocytes 14,000, and hemoglobin, 48 per cent were reported. Physical examination showed a markedly emaciated man, with a palpable epigastric mass the size of an orange. Roentgenologic examination showed a large filling defect on the mid-posterior wall of the stomach, which was thought to be cancer. An exploratory examination was advised.

On opening the stomach, a large pedunculated tumor (Fig 5) about the size of an orange was found attached to the posterior

wall. Its surface was markedly irregular and of a cauliflower appearance. Pathologic examination showed the mass to be a fibromyoma (Fig. 6) with marked inflammatory changes.

tric hemorrhage. She was placed in a hospital, and two transfusions were given. Gastric acidity was normal. The roentgenologic examination, done elsewhere, was said to be negative. Twenty days after the

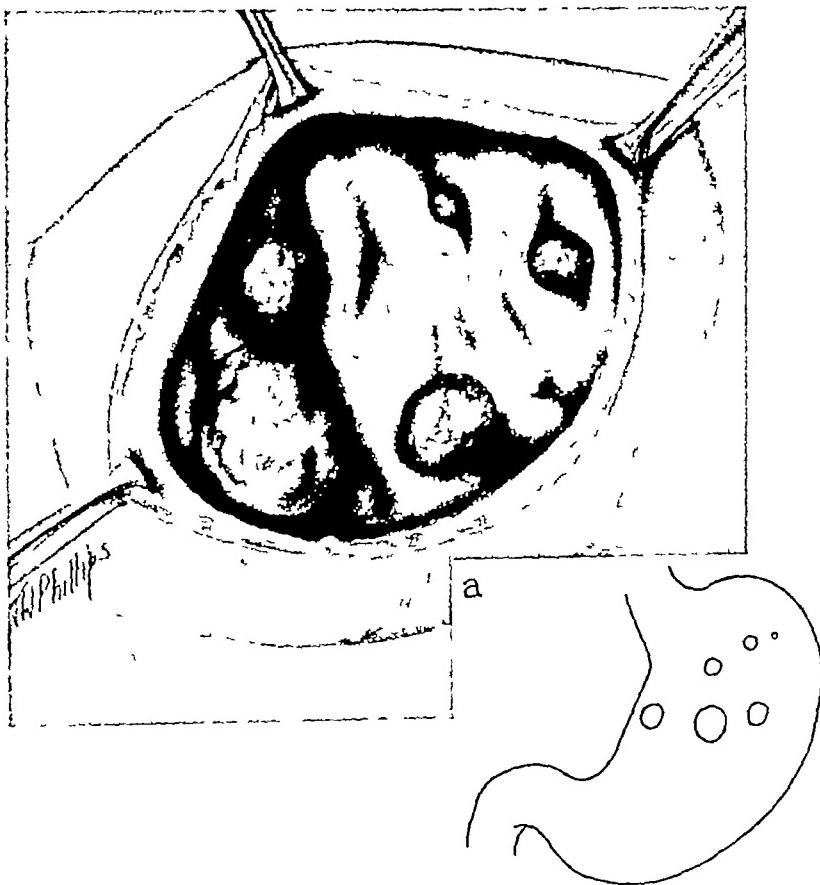


Fig. 4 Case 1 Drawing showing relative positions of the tumors as shown by fluoroscopic examination and the position and relative sizes of the tumors as found at operation.

The patient made an uneventful recovery and returned to Alaska, where he died a year and a half later. According to meager reports obtained from his friends, his stomach was apparently not the cause of his death.

Case 3 A woman, 35 years old, consulted a physician on account of severe gas-

first hemorrhage, another gastric hemorrhage occurred. Sixteen transfusions were given in an effort to get her in condition for operation. A tumor mass was palpated in the upper left quadrant of the abdomen, and, because of the negative roentgenologic findings, the mass was thought to be splenic. Operation was advised. A pedunculated

tumor about the size of a grapefruit was found attached to the posterior wall by a small pedicle. Histologic examination of the tumor showed it to be a leiomyoma

terior wall. The value of the careful palpation of a partially filled stomach during fluoroscopy cannot be emphasized too strongly. If we had not made this method

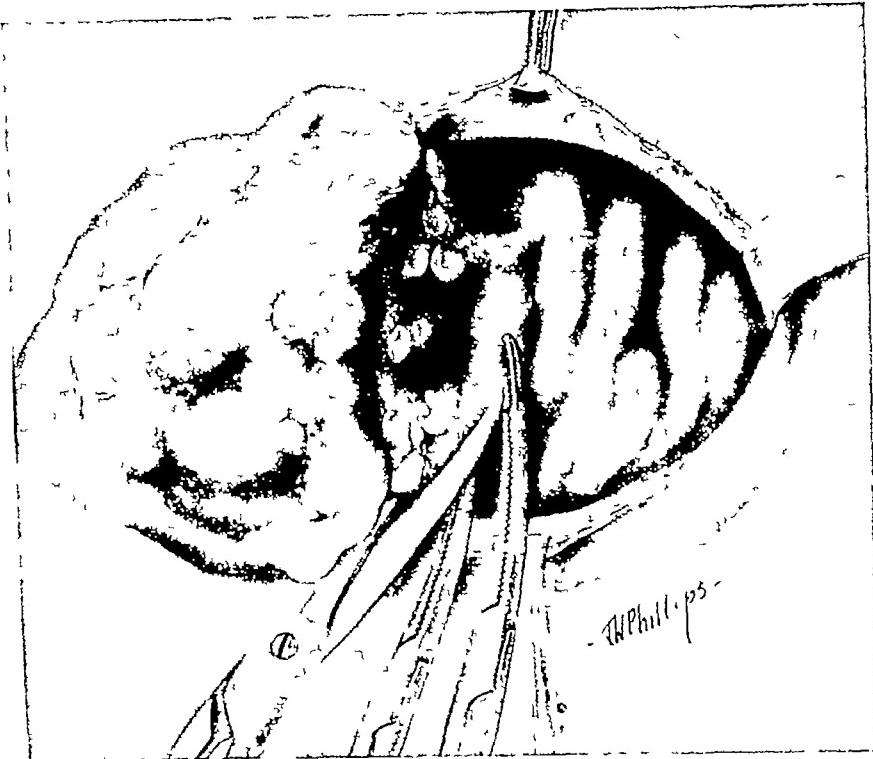


Fig 5 Case 2 Drawing showing the surgical removal of the pedunculated fibromyoma

This patient has been free from symptoms for 9 years

In reviewing these cases, it is readily apparent that the roentgenologic examination was the most important factor in the diagnosis. The clinical signs were very indefinite, and, with the exception of one case presenting severe gastric hemorrhage, there were no symptoms indicative of gastric pathology. All the patients complained of anemia and loss of weight. Two complained of diarrhea, and, in the case with the polyps, severe diarrhea was the sole complaint.

All these tumors were located on the pos-

terior wall. In examination a routine procedure, the small tumors on the posterior wall would have remained undiagnosed.

One must never be hasty in making a diagnosis of inoperable carcinoma. An extensive filling defect seen on a roentgenogram, accompanied by a large palpable epigastric mass, is not always a sign of inoperability. Practically every patient is entitled to an exploratory operation. If for various reasons the mass is not suitable for resection, many will be benefited by an operation for relief of obstruction.

Careful roentgenologic examination of

the stomach accompanied by surgical exploration will go a long way to increasing the number of benign gastric tumors. An early diagnosis is of great benefit to the patient, as a carcinoma may develop on a benign tumor, especially the multiple polypoid variety.



Fig. 6 Case 2 Cross-section of the fibromyoma

A gastric hair ball is a very infrequent cause of a palpable epigastric mass. The case here reported is a large hair ball forming a complete cast of the stomach in a girl 8 years of age.

This child was referred to us 10 years ago on account of a freely movable abdominal tumor. There were no digestive disturbances, the mass was painless and not tender to palpation, the appetite was fair, and there was no loss in weight. Examination of the blood showed hemoglobin 62 per cent, erythrocytes 4,120,000, leukocytes 11,400. The child had acquired the habit of chewing the ends of her curls. Examination of the head showed the hair over the frontal region to be much thinner than elsewhere. From the history of long continued hair chewing and a movable mass in the epigastrium, a clinical diagnosis of gastric hair ball was made.

Roentgenologic examination showed the barium mixture to penetrate slowly between the wall of the stomach and the hair ball.

As the patient continued to drink the mixture, the entire gastric contour was visualized, but the area outlined by the hair ball was faintly shadowed.

The patient was operated upon and a hair mass forming a complete cast of the stomach was removed. At a recent interview, it was found that she has had no after-effects following the experience of hair-eating ten years ago.

SUMMARY

1. The roentgenologist seldom fails to diagnose a gastric cancer, yet, owing to the location of the growth and the failure to recognize early signs of the lesion, the majority of gastric cancers are far advanced at the time of diagnosis.

2. A patient who gives a history of chronic dyspepsia and whose gastric secretions show the presence of free hydrochloric acid may have a cancer of the stomach. This patient is just as deserving of a detailed study to determine or to rule out cancer as is one who consults a physician on account of comparatively recent development of gastric symptoms.

3. In our series of patients with gastric carcinoma 38 per cent give a history of dyspepsia averaging 10 years before the onset of symptoms characteristic of cancer. Seventy per cent of these patients had free hydrochloric acid in their gastric contents.

4. A benign tumor of the stomach, although rare, may be the cause of an atypical gastro-intestinal complaint. Two of the cases here reported complained of no clinical symptoms suggesting a lesion of the stomach. All complained of anemia, loss of weight, and weakness. Persistent diarrhea was practically the sole complaint in one case.

5. The value of careful palpation of the partially filled stomach during fluoroscopy cannot be emphasized too strongly. If this method of examining the posterior wall of

the stomach had not been used routinely, the case with the polyps would not have been diagnosed

6 To quote J C Bloodgood "Do not diagnose inoperable carcinoma from palpa-

tion and X-ray alone Give the patient the benefit of exploration unless there are skin metastases or fluid in the peritoneal cavity Even then, if there is obstruction, operation is indicated "

REVERSE BLOOD FLOW IN HANDS AND FEET TO RELIEVE GANGRENE

An unusual case in which the flow of blood in a patient's hands and feet has been reversed for twenty years has just been reported to the American Medical Association by Dr Bertram M Bernheim of Baltimore

The operation was performed to relieve gangrene which developed as a result of Raynaud's disease, an ailment affecting the smallest arteries and veins When circulation in these is affected, as in Raynaud's disease, the tissues supplied by them do not get proper nourishment, and die

To correct this condition, Dr Bernheim performed an operation linking an artery to a vein in the patient's left leg The blood, which could not get down the diseased artery to the left foot and toes, was able to flow down the vein to the foot Normally, of course, blood flows out from the heart

in the arteries and back through the veins This reversal of blood flow was successful in relieving the gangrene and pain of Raynaud's disease in the left foot Later, when the other foot was attacked, and still later when the disease began to affect the hands, operations were performed to reverse the circulation in these members

The patient, who was 26 years old at the time of the first operation, is now about 45 and in excellent health generally, Dr Bernheim found on examination nearly twenty years after her last operation However, pain has returned and gangrene set in again in the remaining toes of the feet and in one finger The reason for this cannot be determined, nor can the final outcome of the case be predicted, Dr Bernheim stated The openings from arteries to veins in the arms appear still to exist and have probably prolonged the patient's life and health for many years

DIVERTICULOSIS OF THE COLON¹

By FRANZ V GROEDEL, M.D., BAD NAUHEIM, GERMANY

DIVERTICULA are small pulsion pouches or hernia of the mucosa or sub-mucosa (diverticula spuria), or more rarely pulsion pouches of all layers of the abdominal wall of the colon (diverticula vera). Diverticulosis is more common in men than in women. The diverticula are generally situated near the edge of the mesentery. These pockets almost always occur in the sigmoid flexure, more rarely in the rectum. They have been thought to be related to constipation and fecal stasis, so common are they at these points. They can exist for a long time without giving rise to symptoms, but here, as in the vermiform appendix, retention can lead to suppuration and perforation. Aschoff distinguishes two forms (1) Congenital, and (2) acquired, or true and false diverticula. Aschoff (1) also finds that the sigmoid flexure is the most common site.

The diagnosis of diverticulosis is made by X-ray examination. Not much has been heard from radiologists in the literature of Germany (2) about diverticulosis, although most of us have come across this peculiar condition of the bowels.

The following clinical notes may be of interest. A 71-year-old man had been a patient of mine for two years. He had never had any serious illness, but had complained of flatulence and abdominal pain and discomfort off and on for four years, accompanied by loss of weight. On X-ray examination and test meal three years ago, the only findings were abnormally increased stomach motility and achylia. At the time, this condition was considered to be due to pyorrhea, from which he was found to be suffering. In spite of dieting and treatment,

loose stools and attacks of diarrhea soon after meals persisted.

On X-ray examination the following points were noted:

1 Immediately after the barium meal the stomach was completely pressed up against and adherent to the liver. Neither the pylorus nor the duodenum was visible. A few coils of intestine were overfilled and bulging.

2 One and a quarter hours after the meal the stomach was empty but still adherent to the liver. Behind it a fairly normal bulbous was seen. The upper coils of intestine were considerably dilated. The bulk of the barium meal was in the small intestine.

3 Three and a half hours after the meal the cecum and ascending colon were filled. The small intestine was very irregularly filled. Bubbles of air indicated the shadow of the transverse colon, which was displaced upwards.

4 Eight hours after the meal the small intestine was quite empty. The barium mass was collected in the rectum. The cecum was still full of air and the appendix was filled. The only signs of the transverse colon and the colon descendens were round bubbles of air and round spots of shadow. Round pulsion pouches the size of coffee beans were seen in the S romanum.

5 Twenty-five hours after the meal the whole large intestine was visible and contrasting shadows showed its whole course, the ingested food, and the much thinned and retained contents. Numerous pockets were seen over these thin shadows, just at those points which were filled with the barium porridge twelve hours before. The appendix was not quite empty.

6 Thirty-five hours after the meal the appendix was still filled, although complete

¹Read before the Radiological Society of North America at the Thirteenth Annual Meeting at New Orleans La Nov 28-Dec 2, 1927

evacuation of the bowels had occurred. Near the appendix, two large pockets in the right flexure, six diverticula in the transverse colon, and seven in the colon descendens were seen. In the flexure of the S romanum, one large pocket was seen and numerous diverticula in the S romanum.

Diagnosis—Extensive perigastric adhesions of the pylorus region, probably from some cholecystitic process, and diverticulosis of the whole colon (*diverticula vera*).

Shortly after the diagnosis was made, the patient was taken ill with symptoms resembling those he had once previously had, i.e., pain in the region of the sigmoid flexure with temperature. There was considerable tenderness to pressure on this region, and over the course of the whole colon. It was evidently an acute attack of diverticulitis, very similar to an acute appendicitis.

Noteworthy in this case are the extensive distribution of diverticula over the whole colon, the large size of the several diverticula, and the very long persistence of the diverticular shadows.

In his monograph, Strauss (3) maintains that the diverticula of the large intestine can

be distinguished only by X-rays, with the aid of rectal enemas as the only fluid matter that can enter the diverticula. According to De Quervain they are best seen when a part of the enema has left the rectum.

In all cases, Strauss is of the opinion that extreme care and careful criticism should precede diagnosis.

Because in the case cited there was little or no difficulty in demonstrating the condition, we are of the opinion that it is only the diverticula spuria that cause any difficulty of demonstration, and we believe that the rarer and more important diverticula vera can be demonstrated with perfect ease and certainty by the improved technic of to-day.

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TUMORS OF THE MALE BREAST, BASED ON A STUDY OF THIRTY-ONE CASES

By BERNARD F SCHREINER, MD, FACS

State Institute for the Study of Malignant Disease, BUFFALO, N Y
Burton T Simpson, MD, Director

DURING the years 1914 to 1931 (June), there were 17,486 cases admitted to our tumor clinic for examination and treatment. Included in this number were 1,664 diseases of the breast submitted for study, treatment, and observation. Only 31 of these breast lesions were in males. For this reason, it was thought of sufficient interest to tabulate and record the pathologic conditions for which advice was sought.

The following is a comparative table:

| PATHOLOGIC CONDITION | MALES | FEMALES |
|---------------------------------|-------|---------|
| <i>Malignant Lesions</i> | | |
| Carcinoma | 15 | 1,240 |
| Epithelioma skin | | |
| Pearl cell | | 1 |
| Basal cell | | 1 |
| Paget's disease | | 14 |
| Sarcoma | 1 | 4 |
| <i>Benign Lesions</i> | | |
| Chronic mastitis | 4 | 125 |
| Cystic mastitis | 4 | 108 |
| Cystic adenoma | | 17 |
| Papillary cysts | | 13 |
| Polypoid cyst | | 1 |
| Sebaceous cysts | 1 | 2 |
| Adenoma | | 5 |
| Fibro-adenoma | 1 | 62 |
| Myxofibro-adenoma | | 1 |
| Fibro-angioma | | 1 |
| Papilloma nipple | | 5 |
| Fibropapilloma | 1 | 1 |
| Lymphangioma | 1 | |
| Lipoma | 1 | 6 |
| Tuberculosis | 1 | 6 |
| Nevus | | 3 |
| Supernumerary nipple | | 2 |
| Eczema | | 3 |
| Hypertrophy | 1 | 1 |
| Inflammatory lesion and abscess | 1 | 11 |
| | 31 | 1,633 |

number of the cases reported and summarized his findings. It is apparent, from the relatively small number of cases reported, that carcinoma in the male breast is less frequent than in the female breast.

Various observers from time to time have given the impression that carcinoma of the male breast was not so malignant as carcinoma of the female breast. This apparently is an erroneous idea as is shown by subsequent observations of the cases which Wainwright has studied and from observations of our own 15 cases.

Ewing (3), in his book on Neoplastic Diseases, states that the frequency of cancer of the male breast is from 0.8 per cent to 6.0 per cent of all breast cancer, quoting Williams and LaForgue as authority. Deaver and McFarland (4) in their series estimate that 1.5 per cent of the malignant breast tumors and 2 per cent of the benign tumors occurred in men, and that 80 per cent of the tumors of the male breast are malignant. Our statistics show that 1.25 per cent of all the breast cancers admitted were in the male, and that 50.1 per cent of all male tumors were malignant.

Chronic inflammatory lesions often precede the development of malignancy and it is for this reason that benign lesions in the male breast were treated rather radically by amputation of the breast.

Of our 31 cases of tumors of the male breast, 15 were benign and 16 malignant. Among the 16 malignancies, one was a spindle-cell sarcoma. This man, who was 77 years old, gave a history of soreness, drawing sensation, and a small hard lump for eighteen months prior to admission to the clinic. At the time of examination, he

In a recent paper, Neal and Simpson (1) brought to our attention the various diseases of the male breast that were encountered in 5,000 cases. In 1927, Wainwright (2) made an exhaustive study of the literature, both historical and recent, of carcinoma of the male breast. He then analyzed a large

had metastases in the axilla. The tumor was removed surgically and then treated with high voltage X-ray. He died from recurrence and old age four months later.

The age incidence of the 15 cases diagnosed as carcinoma is shown in the following table:

| 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80-89 |
|-------|-------|-------|-------|-------|-------|
| 2 | 2 | 5 | 1 | 4 | 1 |

The youngest was 33 and the oldest 89; 11 occurred after the age of 50.

The history of duration of the lump varied from 1 month to 20 years as shown below:

| | |
|--------------------|---|
| Less than 6 months | 3 |
| 6 months to 1 year | 3 |
| 1 to 2 years | 3 |
| 2 years | 1 |
| 3 years | 2 |
| Over 4 years | 1 |
| Twenty years | 2 |

Wainwright, in his study, also reports several cases with a history of 20-year duration of the lump before treatment.

Biopsy or section was obtained in 12 cases, of these 11 showed scirrhous carcinoma, and one, adenocarcinoma. In the other cases, the lesions were so far advanced that a definite clinical diagnosis could be made without section.

Upon examination, four cases were found to be ulcerating, of these, three were in far advanced stages, and one, in a patient in an early stage in whom only the breast was involved. There were three other cases in which the tumor was confined to the breast and no nodes were palpable, three cases in which only axillary nodes were palpable in addition to the breast tumor, and five other cases in which there were widespread metastases. Four cases were post-operative, recurrent, with widespread metastases. Definite mediastinal involvement was shown in four cases, definite skin metastases, in



Fig 1 Carcinoma of the breast with aleukemic leukemia, at time of admission to the Institute



Fig 2 The same patient, one year after operation and treatment.

three cases, and general carcinomatosis, in one case.

TREATMENT

Three cases (admitted between 1915 and 1920) were treated with low voltage filtered X-ray with unfiltered X-ray over the ulcer, two had high voltage X-ray only, seven had removal of the tumor surgically, followed by high voltage X-ray, and one had high voltage X-ray, radium pack, and implantation of radon seeds in the breast. Two were not treated; one of these had amputation elsewhere but the result of this operation is not known as he did not return to the Institute.

Three of those treated surgically had amputation before admission, they were re-

current, far advanced, when admitted Two died in less than a year and one, somewhere between one and two years

Three cases in which surgery was done at the Institute, no nodes being present at the time of operation, have been well four years, one year, and two months, respectively, or since the time of operation

In one of the cases treated surgically, there were metastatic nodes in the axilla at the time of operation This patient has been well since treatment—two years, seven months

Of those treated by irradiation alone, none was an early case and all but one are dead This one has been treated for two years and five months There has been no progression of the disease The patient refuses amputation though he has been urged several times to submit to it The others died four in less than a year, and one between two and three years

Of these 15 cases, only eight are available for 5-year study Only one had no lymphatic or other involvement This patient has been well for four years He did not submit to amputation until two years after admission, during this time he had high voltage X-ray Section at the time of operation showed carcinoma The other patients have all died

Two of the cases of carcinoma of the breast had complications One patient (Fig 1) had large lymph nodes in the axilla which, at the time of operation, were found

to be hyperplastic Subsequently, the patient developed nodes in the neck The blood findings, 16,800 leukocytes with 75 per cent lymphocytes, confirmed the diagnosis of aleukemic leukemia One, who on section showed adenocarcinoma of the nipple, had had an epithelioma of the penis which had been well for six and one-half years, and an epithelioma of the left corner of the mouth, which had been well for two years

CONCLUSIONS

1 Carcinoma of the male breast is about 1 25 per cent of all cancers of the breast in our series

2 Carcinoma of the male breast is an uncommon disease, sarcoma is rare

3 Carcinoma of the male breast is as malignant as carcinoma of the female breast

4 This disease occurs, as a rule, late in life

5 With few exceptions, patients in our series applied for treatment late in the course of the disease

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THE CONCEPT OF DOSAGE AND THE DEFINITION OF THE r-UNIT (ROENTGEN UNIT)

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Translation by GEORGE L CLARK, PH D, Department of Chemistry, University of Illinois, Urbana

THE two attributes for characterizing and measuring an electromagnetic ray (light, X-rays, γ -rays) are the wave length and the intensity. Two rays with equal wave length are qualitatively equal, they possess, for example, equal penetration power. The measurement of wave lengths is made by the spectrographic method. The radiation intensity is a measure of quantity, it corresponds to what is ordinarily termed quantity of radiation. In the newer definition, the radiation intensity is that radiation energy which strikes in one second upon a surface of 1 sq cm perpendicular to the direction of the ray. An absolute measurement of intensity for X-rays is very difficult and depends upon the very minute increase in temperature resulting from the complete absorption of the rays in any irradiated object. For all other effects of X-rays (ionization, photographic plate, fluorescent screen, selenium cell, skin erythema, etc.), the degree of action depends on the radiation intensity and also on the wave length. On this account a different fraction of the initial radiation intensity for different wave lengths is transformed in the irradiated medium into other energy forms. The action is, therefore, independent of the wave length only when the beam of given initial intensity inclusive of the secondary rays arising therefrom is completely absorbed in the irradiated material—a condition which can be realized practically only with methods based on the thermal effect. How great can be the difference in the dependence of the sensitiveness of different methods of measurement upon the wave length is demonstrated in Figures 1 and 2.

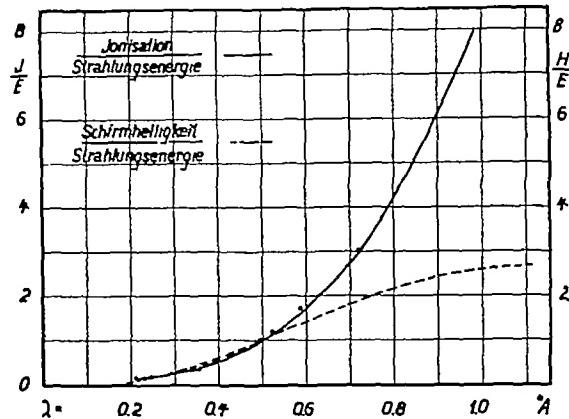


Fig. 1

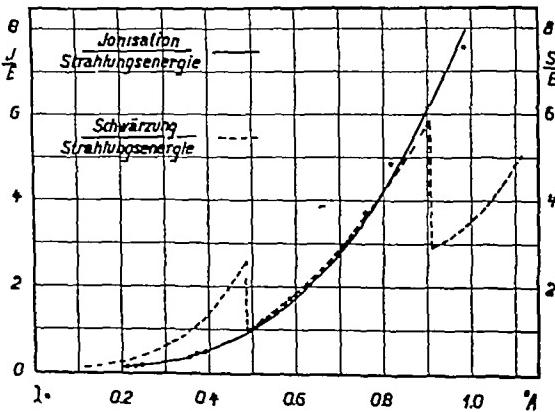


Fig. 2

If different homogeneous rays, i.e., rays which possess only a single wave length, fall simultaneously with equal intensity upon an air ionization chamber, a fluorescent screen, and photographic plate, the brightness of the screen changes much less with wave length than the ionization current (1). Upon comparison of the ionization and blackening of the photographic plate, it is especially noteworthy that the photographic sensitiv-

ness changes with sudden jumps in two places (0.49 and 0.91 Ångström unit) Since these wave lengths coincide with the discontinuities in absorption coefficients of silver and bromine, the two effective constituents of the photographic emulsion, it must be concluded that the photographic action is closely connected with absorption Not only for the photographic effect but also in other cases, for example ionization, the following principle holds the action of rays changes with wave length in the same way as the intensity of the absorbed portion of the incident rays changes Exceptions occur in the region of very short wave X-rays, when the Compton effect is appreciable, and in the case of the excitation of characteristic fluorescent rays of the irradiated material A very recent investigation has now demonstrated that all known physical and chemical effects (2) are governed by a simple law, the law of electron transfer The effect changes with the wave length in the same way as the fractions of the incident radiation energy transformed into the energy of photo- and Compton electrons This value may be calculated for certain chemical compositions of a material from physical data (absorption coefficient recoil coefficients, etc.) The good agreement between theory and experiment is shown in Figure 1 for the case of ionization, the circles corresponding to experimental values, the curve itself being theoretically calculated The earlier mentioned law of proportionality of the effect in the absorption constitutes a special case of the general law of electron transfer if no characteristic radiation is generated, the whole absorbed energy is transformed into the energy of photo-electrons and both magnitudes change in the same way with wave length, further, if the radiation is not of such short wave length that Compton electrons with appreciable energy appear, the chemical or physical effect coincides with the energy of the photo-electrons alone

The knowledge of the fundamental laws of physical and chemical radiation effects is of important use for a discussion of the dosage problem The idea of dosage arose from the immediately practical necessity to provide for therapeutic irradiation a physical measurement determined independently of the wave length of the rays for the intensity of the biologic reactions, especially for the skin erythema Since the primary process of a biologic effect is a physical-chemical one, it is to be expected that equal intensities of two qualitatively different X-rays would possess different biologic effectiveness Apart from the already mentioned difficulties of an absolute intensity measurement, such a method would also constitute an entirely impracticable dosage measurement for therapy, since the biologic action changes from wave length to wave length even for conditions of equal incident intensity The aim of practical dosage measurement must, therefore, consist in the selection of a radiation effect as the basis for dosage measurement which changes with the wave length in the same way as a given biologic reaction, for example, the production of skin erythema The measurement of the ionization current in air under conditions in which the wall effect is eliminated has served in this respect empirically as the most important method of dosage measurement apart from very soft rays (Bucky's Grenz rays) for which the inhomogeneity of absorption for different parts of the skin plays an important part, a complete parallelism between skin erythema and air ionization existing independent of the quality of the radiation (3)

The conception of dose was first formulated exactly by Christen (4) in the year 1913 *The physical dose is the radiation energy absorbed in a volume element of a body during the time of irradiation divided by the magnitude of the volume element* Since the radiation energy falling upon the

different deep lying points of a body is greatly different, it is essential to proceed to the definite establishment of such a small zone of the irradiated body that within this zone an average constant radiation energy can be calculated with sufficient accuracy. In this case instead of the exact expression for the radiation intensity absorbed in the thickness "D" for an X-ray beam with absorption coefficient

$$(1) \quad I_1 - I_2 = I_1 (1 - e^{-\mu D})$$

it is permissible to make the approximation (expansion of the exponential function to a series)

$$(2) \quad I_1 - I_2 = \bar{\mu} D$$

The total absorption radiation energy in a cubic volume element with the surface "Q" and the height "D" in the exposure time "t" is then

$$(3) \quad \bar{\mu} D Q I_1 t$$

After division by the size of the volume element "Q D" there is obtained by definition the dose "X". It is, therefore,

$$(4) \quad X = \bar{\mu} I_1 t$$

In other words the dose "X" is equal to the product of the absorption coefficient, the intensity of the incident ray, and the exposure time

Against the dose idea of Christen it may be objected that it is practically unusable since one is ordinarily not in the position to measure the intensity I_1 by simple technical methods. Nevertheless this idea has been of greatest usefulness for dosimetry. It contains an expression at that time by no means experimentally capable of verification accounting for how the biologic action changes with radiation quality. It gives, therefore, a lead for finding out a physical effect which is characterized by the same dependence upon wave lengths as skin erythema.

It is evidently necessary to find the effect upon a material which corresponds in its

absorption properties to tissues or water. Since the absorption coefficient depends not only upon the wave length but also upon the density and the atomic number of the elements constituting a material, it is to be expected that the air, consisting of the light elements, oxygen and nitrogen, should possess the same absorption properties as the tissues, consisting of organic compounds of carbon, nitrogen, and oxygen.

Experimental researches have fully substantiated this expectation. At the second International Congress of Radiology in 1928, as an outgrowth of the work of Szilard, Friedrich, Behnken, and others, the measurement of air ionization was accepted as the basis of international dosage measurement and a definition was given of the unit of dosage designating a roentgen unit and written in abbreviated form as "r". *The absolute unit of X-ray dosage is derived from that X-ray energy which, by the irradiation of 1 cubic centimeter of air at 0° centigrade and 760 millimeters mercury pressure, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.* How does this definition of dose compare with that of Christen? If an exception is made, first, of the short wave length region on account of Compton scattering, it is true as was explained in the introduction that the air ionization is proportional to the radiation intensity absorbed in the volume unit of air. The product of the ionization current and the time of irradiation (5) is, therefore, a measure for the dose in air in the sense of Christen's definition. Since the dependence upon wave length of the absorption coefficients of light atomic substances is the same, the dose in air is proportional to the dose in the tissue. It follows that the roentgen unit, aside from a practically negligible proportionality constant (6), measures the

physical dose in the tissue as was first defined by Christen

The observation found in the literature that the introduction of the roentgen unit involved the proposal of the original definition of the conception of dose is, therefore, an error. The knowledge of the fundamental laws of physical and chemical action of X-rays leads to the possibility of so extending the idea of dose that it will apply for all X-ray wave lengths. As was indicated in the introduction, the proportionality of the effect to the absorbed radiation energy is only a special case under certain assumptions of the general law that the electron transfer (total kinetic energy of the liberated photo- and Compton electrons) is determinative for the physical and chemical effects and their changes with wave lengths. Upon analogous grounds, the same thing would be expected for the biologic action. Against the conception that X-rays act upon the cells in such a way that, first, electrons are liberated from the irradiated atoms, and, then, the action of these electrons gives rise to the initiation of cell destruction, have appeared researches of Politzer and Pauli (7) in which it has been discovered that in the irradiation with cathode rays of salamander larvae a kind of nuclear pectosis (stainability of spindle fibers) was found which was never observed in irradiation with X-rays. It must be concluded from this that the action of electrons and of X-rays is of a different type. More recently (8), however, it has developed that it is possible to obtain the same effects also with X-rays provided that extremely large dosages, several hundred thousand r in a few minutes, are applied in short time. Thus this experimental exception refutes the earlier conclusion.

When it is borne in mind that the definition of the roentgen unit is derived from ionization in air and that the validity of the proportionality of the effect with the elec-

tron transfer has been experimentally proved (Fig 1), it is possible in two different ways to proceed to the following generalization of the Christen definition of dose. *The physical dose is the electron energy (kinetic energy of photo- and Compton electrons) liberated by the action of X-rays in a volume element of the irradiated body during the time of exposure divided by the size of the volume element.* In equation 4 above in place of absorption coefficient $\bar{\mu}$ is substituted the expression $\alpha\bar{\mu} + \sigma_r$ in which α means the fraction of the absorbed energy which is changed into the energy of the photo-electrons. In the region of the ordinary therapeutic X-rays, α is made equal to one on account of the absence of the characteristic radiation in biologic objects. The recoil coefficient σ_r is an expression for how much of the X-ray energy scattered in the Compton effect is transformed into the energy of Compton electrons. For the wave length region ordinarily utilized in therapy, the dose and the unit of dose are clearly established. In going over to the extremely long wave X-rays, 4 Å U and more, however, the following difficulty arises out of the definition of the roentgen unit upon the basis of air ionization: the absorption edge of argon at 3.86 Å U results in the absorption in air changing discontinuously at this wave length, whereas the same phenomenon does not take place in tissues or water. The dose in air and the dose in the tissue are, therefore, no longer proportional to each other. The magnitude of the argon discontinuity can be determined with the help of new gas absorption measurements of Wornle (9). The chemical composition of air in weight percent according to Ramsay (10) is as follows:

| O ₂ | N ₂ | Ar | Kr | X | Ne | He | CO ₂ |
|----------------|----------------|-----|-------|-------|---------|----------|-----------------|
| 23.2 | 75.5 | 1.3 | 0.028 | 0.005 | 0.00086 | 0.000056 | 0.046 |

Among the rare gases only argon has an appreciable effect upon the absorption. The ratio of the mass absorption coefficients of

air containing argon, and argon-free air has the value 1.088 for wave lengths shorter than 3.86 Å U and 1.1 for wave lengths longer than 3.86 Ångstrom units. Since, according to Gartner (11), the work of ionization in argon is about 19 per cent smaller than in air, the contribution of the argon atoms to total ionization is greater than corresponds to their portion of the absorbed energy. For long wave rays above 3.86 Å U, ionization in argon-containing and in argon-free air is equal, while below the argon absorption edge the ionization in argon-free air is only 0.84 as great as in ordinary air. Now since biologic objects in general contain no higher atomic elements in such concentrations (12) that their absorption edges are appreciable in comparison with the total absorption, this result means that for wave lengths less than 3.86 Ångstrom units, for dosage measurement in r units, the dose in biologic objects is about 18 per cent greater than the number of r units indicates. The dose so measured is too small. Taking into consideration the effect of the krypton absorption edge, this number is increased about 2 per cent more (13). Although at the moment the question of the extension of the definition of the roentgen unit for the extreme wave length region has no very important meaning for therapy, a consideration of the increasing application of long-wave rays in biologic researches (Lacassagne and Holweck, 14, Wyckoff, 15) will very soon necessitate a final and definite solution to the problem. On this account it must, therefore, be established that magnitude of the dose will not change for all therapeutically used X-ray wave lengths. For the definition of the r unit, all gases can be utilized which in the long wave length region are free from absorption edges, for example, a nitrogen-oxygen mixture of 23.5 weight per cent O₂ and 76.5 weight per cent of N₂, or carbon dioxide. Carbon dioxide is

proposed upon the grounds of practical simplicity. A new wording of the definition of the roentgen unit would, therefore, run somewhat as follows: *The absolute unit of the X-ray dose is derived from the fraction X of that X-ray energy which, when the secondary electrons formed in the gas are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimeter of carbon dioxide gas at 0° centigrade and 760 millimeters mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.* The magnitude "X" can be determined by simple comparative measurements once for all cases with an ionization chamber filled with air and with carbon dioxide. Since the effective atomic numbers of both gases are approximately equal, "X" must correspond approximately to the ratio of densities, namely, the number 0.66. With this new wording, a real proportionality between dose in standard gas and dose in biologic object should exist. This substantiates the possibility of undertaking all practical dosage measurements for therapeutic irradiation with air ionization chambers.

SUMMARY

1 It is shown that the formulation of the idea of dose given by Christen and the definition of the roentgen unit agree with one another.

2 An expanded definition growing out of the fundamental laws of physical and chemical effects of X-rays is given for the concept of dose.

3 For support of the proportionality of the dose in the biologic object and the dose in the standard gas, even upon the long wave length size of the argon absorption edge, a new wording of the definition of roentgen unit is proposed.

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HORMONE PRODUCTION MAY DEPEND ON MANGANESE

Studies indicating that the formation of a hormone by the pituitary gland is in some way related to the manganese of our daily diet have been described by Dr E V McCollum, of the Johns Hopkins School of Hygiene and Public Health, at the meeting of the National Academy of Sciences. He pointed out the relation of iodine to the thyroid gland, of calcium to the parathyroid glands, and said that apparently another glandular system had been linked with an inorganic element which is essential to the diet.

Rats deprived of manganese exhibit strange behavior and bodily changes, Dr McCollum and his associate, Dr Elsa Orent, have found. The sex glands of the male rats degenerate until complete sterility results. The females, however, continue to have litters of living young but do not show any sign of ordinary maternal solicitude. Normal mothers seem to detect something

wrong with the young of manganese-free mothers and abandon them, although normal rats will ordinarily care for each other's young when the litters are exchanged. "The addition to the manganese-free diet of as little as five-thousandths of 1 per cent of manganese results in correcting the behavior of the female rats toward their young," Dr McCollum said.

Other workers have reported that male sterility in middle life is related to deficiency of the pituitary hormone, and that the pituitary gland stimulates milk secretion. Dr McCollum suggested that since manganese-deprivation had the same effect, the dietary manganese may be related in some way to hormone formation by the pituitary gland. However, there is no need to worry over possible lack of manganese, as one worries over lack of vitamins, it appears, for Dr McCollum reported that at the beginning of the experiments great difficulty was encountered in removing manganese completely from the diet.—*Science Service*

INTERNATIONAL COMPARISON OF X-RAY STANDARDS¹

By LAURISTON S TAYLOR, WASHINGTON, D C

Abstract—Direct comparisons between the X-ray ionization standards of the United States, England, Germany, and France are described. The small guarded field ionization chamber was used as the working standard and transported to the several laboratories. Careful check of the instrument calibration at each laboratory showed no change due to transportation. Complete corrections were made for air absorption, differences in current measurements, and differences between chamber diaphragms. The final agreement between

the United States, English, and German standards was ± 0.5 per cent. The ratio between the international roentgen and Solomon's unit for hard radiation (HVL greater than 0.75 mm Cu) was 2.29. As a result of diaphragm discrepancies found in England, a study of diaphragm measurements was made. It was found that lead diaphragms tended to warp with age, rendering difficult an accurate determination of their area. Plug gauge and micrometer microscope measurements were averaged for the final results.

I INTRODUCTION

THE unit of X-ray quantity known as the "roentgen" has within the last few years become very generally used in applied radiology. In the meantime, many investigators have studied the problem of devising an equipment which will unambiguously measure an X-ray beam according to the definition of the international roentgen as proposed by the Second International Congress of Radiology in 1928² and many important features overlooked by the earlier investigators have been brought out.³ There has at the same time been set up in the national laboratories of England, Germany, and the United States standard open-air ionization chambers in terms of which dosage meters for the particular country are calibrated.^{4, 5, 6}

Other countries, not having centralized

standardization laboratories, have designated certain private or state institutions as recognized custodians of the standard. In France, Dr I. Solomon, at L'Hôpital St Antoine, is the official custodian.

Since the different national standards have been designed and constructed independently, it is natural to find that no two are exactly alike, even though the basic principles involved in all are the same. On account of these differences the most obvious question was how closely these several standards agreed.

The first attempt at comparison was made in 1927 by Behnken.⁷ For this purpose he carried a pair of carefully controlled thimble chambers, which had been calibrated against his standard, to several laboratories for comparison. His results revealed a difference between several American laboratories (not including the Bureau of Standards, since we had no X-ray standardization equipment at that time) and the Physikalisch-technische Reichsanstalt of some ± 4 per cent. More recent studies^{8, 9} have shown that an ambiguous calibration is ex-

¹Preliminary report read by L. S. Taylor at the Third International Congress of Radiology, Paris July 29, 1931.

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²The roentgen is defined as "the quantity of X-radiation which when the secondary electrons are fully utilized and the wall effect of the chamber is avoided produces in one cubic centimeter of atmospheric air at 0° C. and 760 cm mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current."

³L. S. Taylor, RADIOLGY January, 1931, XXVI, 113.

⁴H. Behnken, Strahlentherapie, 1927, XXVI, 70.

⁵L. S. Taylor, Bureau of Standards Jour. Research (R P 56), 1929, II, 771.

⁶G. W. C. Kaye and W. Binks, British Jour. Radiol. December 1929, II, 553-578.

⁷H. Behnken, Strahlentherapie, 1928, XXIX, 192-198.

⁸L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R P 169), 1930, IV, 631.

⁹L. S. Taylor and G. Singer, RADIOLGY August, 1930, XXV, 227-240.

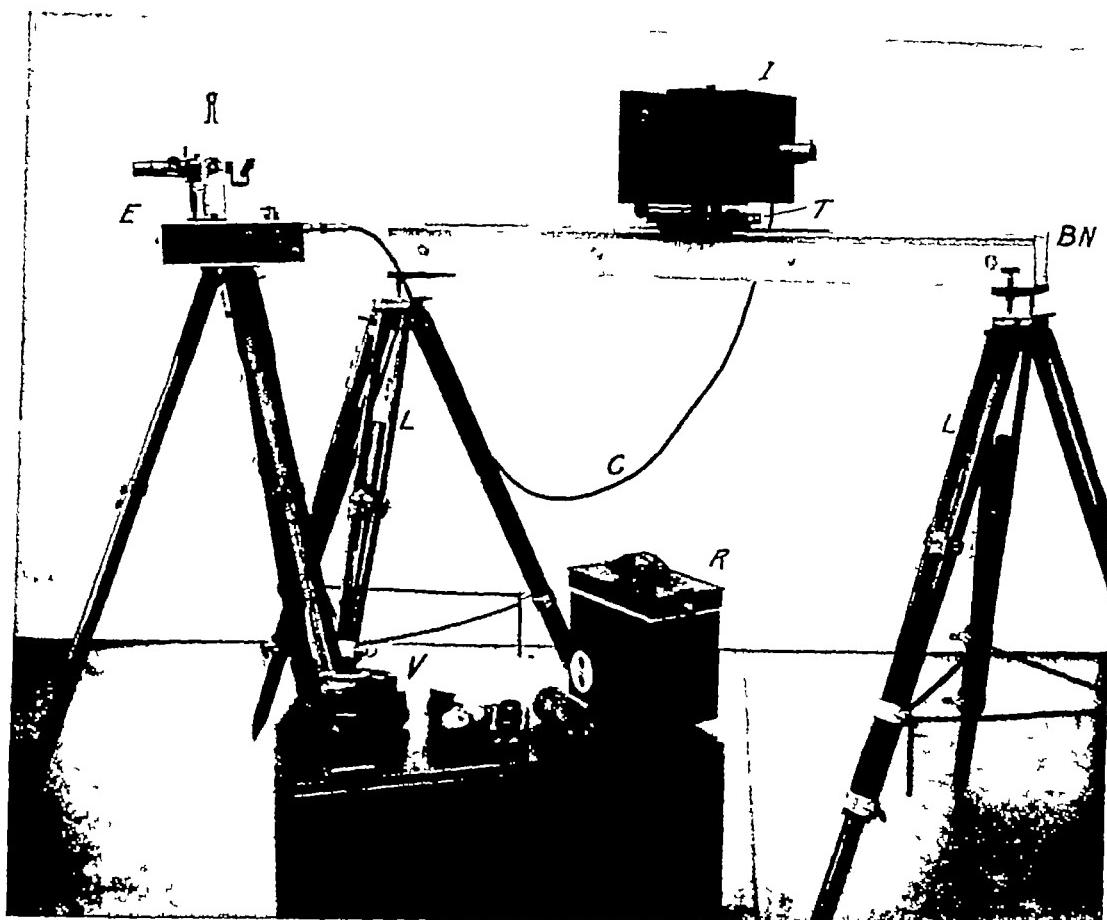


Fig 1. Photograph of complete X-ray standardization equipment.

ceedingly difficult Behnken's comparison measurements were made with a magnesium thimble chamber which, therefore, had a considerable dependence upon the radiation quality as compared with an open-air ionization chamber. The impossibility of reproducing the necessary radiation qualities in the different laboratories consequently influenced accuracy of the measurements in an unfavorable way.

It appeared, therefore, that a direct comparison among the standards themselves would be the only reliable method.¹⁰ This has heretofore been practically precluded by the very great weight and size of these open-air standards. The guarded field ionization

chamber developed in this laboratory^{11, 12} appeared, however, to be sufficiently compact to transport, so the Bureau arranged for a comparison with the national laboratories of England, Germany, and with Dr Solomon's laboratory of France.

II PORTABLE X-RAY STANDARDIZATION EQUIPMENT

(1) Description of Apparatus

The working standard used in these comparisons was a small guarded field ionization chamber previously described^{11, 12} though some minor modifications from that

¹¹L. S. Taylor and G. Singer, Bureau of Standards Jour Research (R P 211) 1930 V 507

¹²L. S. Taylor and G. Singer, RADIOLoGy December 1930

V 637-646

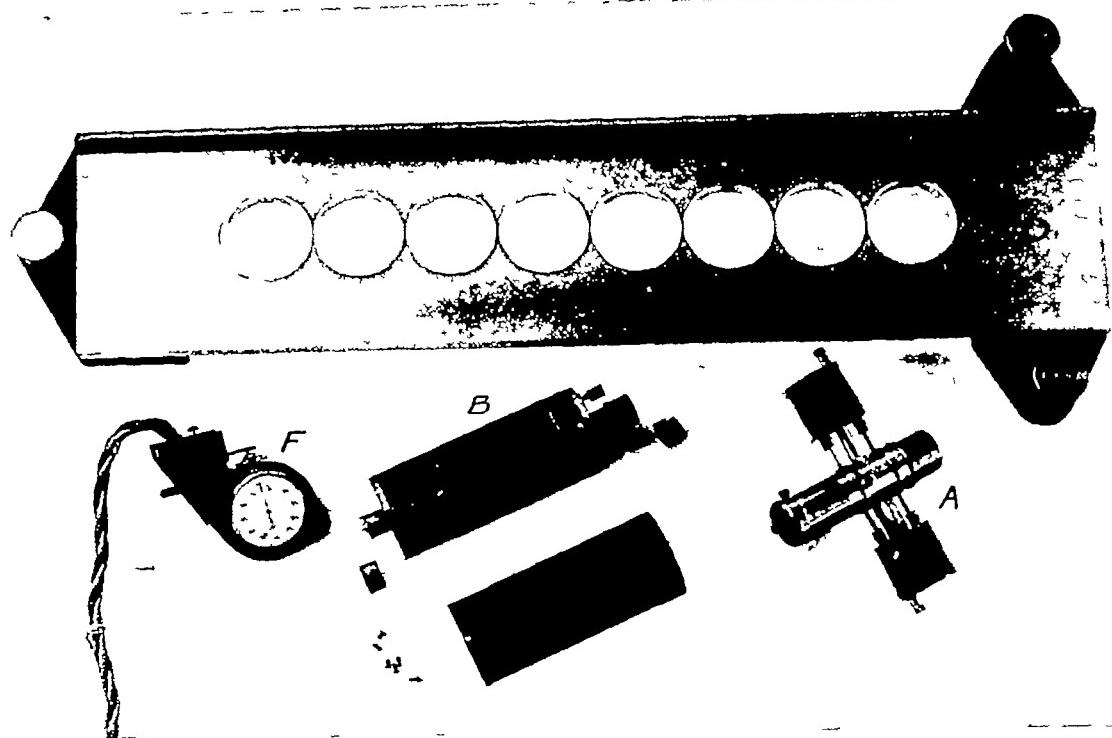


Fig 2 Accessory equipment.

description were made to facilitate the more ready alignment in the X-ray beam. At the same time, the beam was isolated from the guard wires by reducing their number from 12 to 8, which permitted a spacing of 1.8 cm between the central pair. With the chamber diaphragm of only 0.8 cm diameter there was little likelihood of the beam striking the wires unless the chamber was placed abnormally close to the tube. The change in spacing of the guard wires necessitated, however, an increase of 3 cm in the length of the surrounding box to maintain a uniform electric field between the collector plates. To insure ruggedness the older potential dividing resistors of carbon were replaced by wire-wound resistors.

The current measuring system used (*E*, Fig 1) has already been described^{13, 14}. In

this, the electric charge furnished by the ionization chamber is entirely localized in a condenser which has one plate connected to the ionization chamber collector electrode and the other to a source of continuously variable potential. The localization is effected by maintaining the receiving line at a constant potential by properly changing the variable potential. This change in potential measures the accumulated charge. The null reading electrometer is connected to the ionization chamber (*I*) by a flexible rubber cable (*C*) surrounded by an earthed copper sheath. It may be noted that since, in the current measurements, the potential of the system is maintained at zero, cable leakage plays no part in the magnitude, but merely affects the sensitivity.

To derive the current, two different timing devices were used as circumstances demanded. The first was a magnetically operated lead shutter (*A*, Fig 2) to fix the ex-

posure interval to the X-ray beam entering the ionization chamber. The second was a magnetically operated switch (*B*), placed in the electrometer circuit to disconnect the measuring system from the ionization chamber. The second method is less desirable than the first, because breaking the connection changes the capacity of the system, this requiring that the electric switch be operated only when the electrometer indicates zero potential, and that no adjustment of the compensator be made after opening the switch.

Both shutter and magnetic switch are operated and timed by means of a combined stop watch and two-way switch (*F*, Fig 2). The switch is adjusted to operate at the instant the stop watch is started and stopped, during which interval the operator balances the ionization current by changing the voltage *V* of the compensating condenser. The ratio of the compensating voltage *V* to the interval *t* is proportional to the ionization current.

Saturation voltage for the ionization chamber was supplied from a compact 2,000-volt kenotron rectifier (*R*, Fig 1), having a filter capacity of 1 micro-farad. The current drawn off by the potential divider for the guard wires, being only 4×10^{-4} amperes, introduces no appreciable ripple in the saturation voltage.

The ionization chamber was mounted on a swivel table and short cross slide (*T*), for adjustment in a direction at right-angles to the beam in the horizontal plane, and the cross slide in turn mounted on an aluminum optical bench (*BN*) for adjustment along the beam. Two such benches were used—one 5 feet long (*B*) and the other about 20 inches (*D*, Fig 2). A pair of rugged adjustable tripods (*L*) were used for supporting the optical benches.

For transportation, the entire equipment and a few spare parts were placed in the three cases. The two smaller ones containing the chamber, electrostatic compensator

(*E*), and voltmeter (*V*) were carried by hand throughout the journey, while the large one containing the accessories and 2,000-volt generator was shipped.

(2) Accuracy of Calibration

The accuracy of the compensator depends solely upon the fixed capacity in the compensator case. The calibration of this capacity was checked in each laboratory before it was used. The values of the calibration constant k_0 ,¹⁵ as obtained at the various places, are given in Table I. In addition, a complete calibration of the fixed capacity of the compensator was also carried out in Teddington, giving a value of $828.4 \mu\text{f}$ as compared with $828.2 \mu\text{f}$, obtained before leaving and after returning to Washington. In the final calibration, a variable capacity was used with its series of capacity differences accurate to within 1/10 per cent. No deviation from the mean in any determination exceeded 1/10 per cent.

The voltmeter used for measuring the compensating potential was corrected to 1/10 per cent, a number of checks during the journey indicated that no changes occurred in transit.

Our earlier investigations led to a definite set of requirements which were adhered to as closely as possible in all comparisons. First, a replacement method of measuring the radiation was chosen since it eliminates any uncertainty as to quality variations over the area of the beam, then it is necessary to have the X-ray beam uniform over the area of the chamber diaphragm. Experience has shown that this must be tested for each set-up, visual alignment may lead to error.

Corrections for loss of radiation by absorption in the air between the chamber diaphragm and collector electrode were also

¹⁵ k_0 is the ratio of the potentials V_a/v_0 where v_0 is the potential induced on the insulated system by the application of V_a to the compensator condenser, when all external capacities are removed from the compensator. A determination of k_0 serves as a check on the calibration of the capacity.

TABLE I—COMPENSATOR CALIBRATION CONSTANTS (k_0) OBTAINED IN DIFFERENT LABORATORIES

| | k_0 |
|------------------------------------|--------|
| Washington (May 1, 1931)..... | 1.045. |
| Teddington (N P L)..... | 1.045. |
| Berlin (P T R)..... | 1.045. |
| Paris (L'Hôpital St. Antoine)..... | 1.046. |
| Washington (Sept. 4, 1931)..... | 1.045. |

TABLE II—COMPARISON OF COMPENSATORS WITH MEMORIAL HOSPITAL

| Radium compensator | Electro-static compensator | Per cent difference | Average deviation B S |
|--------------------------------|--------------------------------|---------------------|-------------------------|
| 13.11 e.s.u. 1.248 0.597 | 13.18 e.s.u. 1.242 0.593 | —53 +24 +66 | ±0.9% ±0.2% ±0.2% |
| | | Average +12 | |

considered necessary, though with the guarded field chamber this correction has been reduced to a minimum which is negligible for the highly filtered radiations. With some of the larger air chambers, however, this cannot be neglected anywhere within the practical range of wave lengths

Data for the absorption of heterogeneous radiation in air are very incomplete, hence it was deemed necessary to interpolate between known coefficients for many radiation qualities encountered^{16, 17}. The values in this work so obtained are probably accurate to within about 15 per cent

III COMPARISONS IN THIS COUNTRY

Measurements have been previously described which show an average agreement between the large open air ionization and the earlier guarded field (12 wire) chamber, closer than 0.1 per cent¹⁸. Comparisons between the earlier 12-wire chamber and the present 8-wire chamber showed agreement within 0.2 per cent

In co-operation with Dr G Failla, a comparison of the Bureau's current measur-

¹⁶M. Siegbahn, *The Spectroscopy of X rays*, Appendix Table III, Oxford University Press, London, 1925

¹⁷L. S. Taylor and G. Singer, *Bureau of Standards Jour Research* (R.P. 271), 1931, VI, 219

¹⁸L. S. Taylor and G. Singer, *Bureau of Standards Jour Research* (R.P. 211), 1930, V, 507

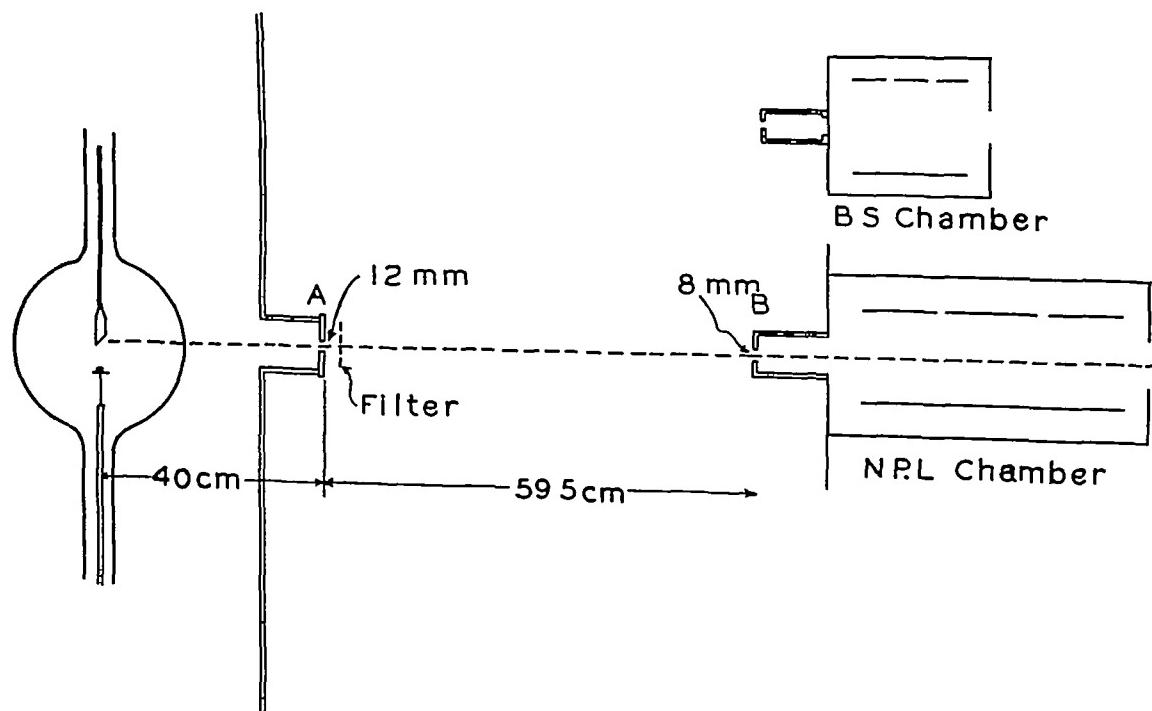


Fig. 3 Diagram of X-ray system in Teddington

ing system with that of Memorial Hospital of New York¹⁰ was made, theirs being the only laboratory in this country which uses null compensation methods. This was primarily to be certain that our system

trial applied to the radium chamber, the resultant current was compensated for a convenient length of time. Measurements over a 20-fold range of current are given in Table II.

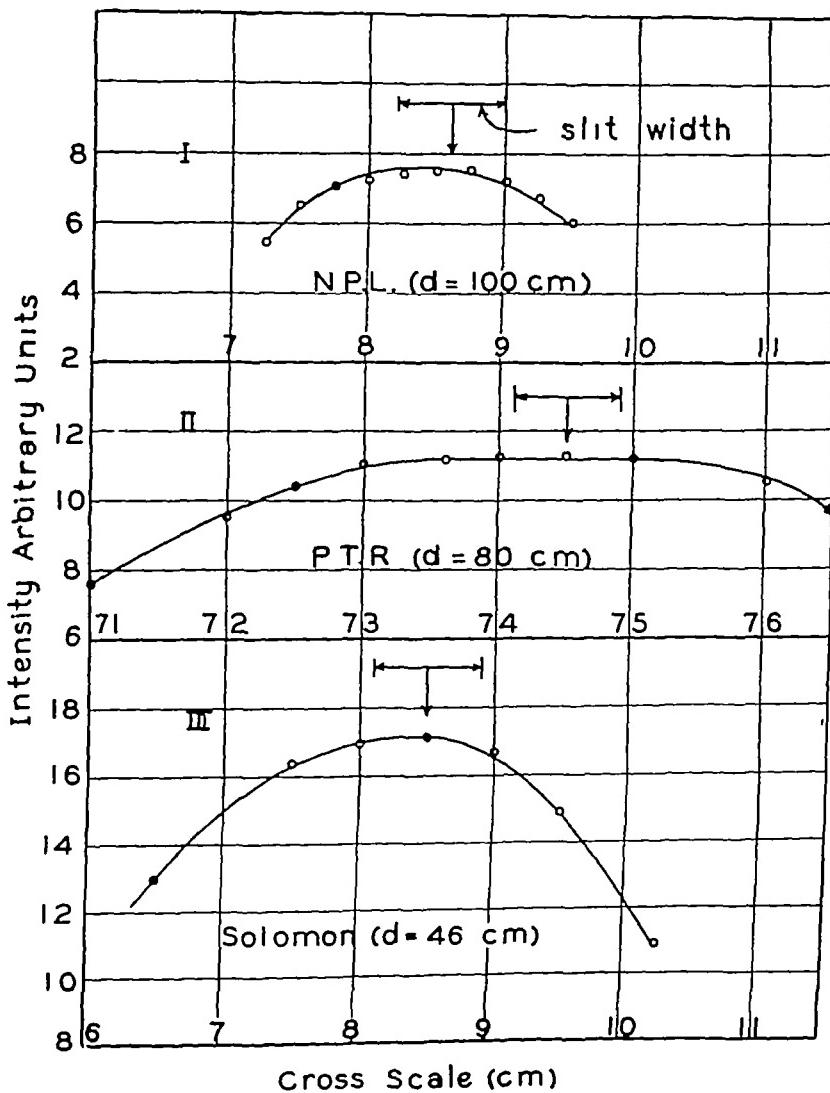


Fig. 4. X-ray intensity distribution across X-ray beams

would stand transportation. For comparison, the B S compensator was simply connected directly to Failla's calibrated radium ionization chamber. With a steady poten-

It will be noticed that the small differences are progressive, the radium compensator readings becoming more negative with respect to Bureau readings as smaller currents were used.

IV COMPARISON WITH NATIONAL
PHYSICAL LABORATORY

(With the co-operation of Dr G W C
Kaye and Mr W Binks)

The new N P L chamber is of the Duane type with a 10-cm plate spacing. A diagram of the set-up for making the comparison is shown in Figure 3. Their X-ray

Curve I, Figure 4, shows in arbitrary units the distribution of intensity across the X-ray beam as obtained by moving the chamber across it. It should be pointed out that the relative narrowness of such a peak is largely due to the effective slit width of the chamber diaphragm used to "explore" the beam. Some measurements made with a smaller diaphragm indicated a more nearly

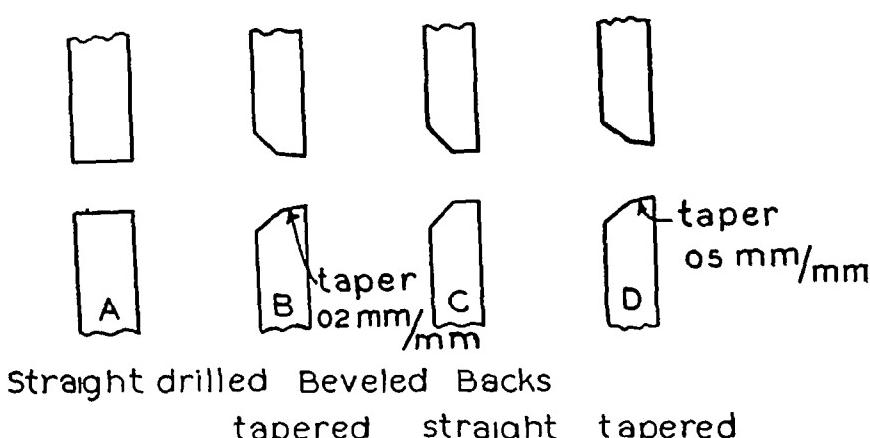


Fig 5 Types of diaphragms used

tube, of the Coolidge deep therapy type, was in a horizontal lead box with a limiting diaphragm (*A*), 12 mm in diameter, at about 40 cm from the target. The ionization chamber diaphragm (*B*) was 8 mm in diameter. The collector electrode (*C*) had a nominal effective length of 8 cm and its center was approximately 35 cm from the diaphragm. They used a null electrostatic compensator to measure the ionization current. Both ionization chambers were mounted on a short cross slide which was, in turn, mounted on a heavy optical bench. (It happened that the Bureau chamber fitted exactly on the N P L track.) The replacement method of observation was used, the two chambers being shifted alternately to position for observation. This distance was so fixed that the front face of the chamber diaphragm was in both cases at the same distance from the target (about 100 centimeters).

uniform distribution. In any case both chambers were very sensitive to alignment. The operating position of the chambers in the beam is indicated by the arrow.

The two compensating systems were separately compared by using them alternately to measure the ionization in the N P L chamber while the X-ray output was maintained constant according to meter readings. In this comparison the B S instrument read 1.47 per cent higher than that of the N P L.

During the comparison of chambers it was found that the chamber diaphragms of the two equipments had different effective areas not accounted for by the difference in their diameters. The N P L diaphragm was about 9 mm thick and the hole was cylindrical (*A*, Fig 5). The B S diaphragm (*B*, Fig 5) had a taper of .02 mm per mm length and was approximately only 4 mm thick along the face of the hole. Depending upon such factors as the focal spot diam-

TABLE III — COMPARISONS WITH THE NATIONAL PHYSICAL LABORATORY

| Run | K.V | Filter Cu | H.V.L. (copper) | r/min B S observed | r/min N P L observed | Air absorption correction | Corrected for air absorption | B S/N P L per cent difference after correction | Corrected for diaphragms | B S/N P L per cent difference after correction | B S precision |
|--|-----|--------------|--------------------|-----------------------|-------------------------|------------------------------|---------------------------------|--|-----------------------------|--|------------------|
| 1 | 110 | 0 | 0.11 | 4.30 | 3.98 | 1.5% | 4.04 | -6.2 | 4.26 | -0.93 | ±1.2% |
| 2 | 110 | 0 | 0.11 | 4.51 | 4.13 | 1.5% | 4.19 | -7.4 | 4.33 | -1.9 | ±0.7% |
| 3 | 143 | 0.14 | 0.5 | 1.295 | 1.205 | 0.6% | 1.21 | -6.4 | 1.28 | -1.32 | ±0.9% |
| 4 | 110 | 0 | 0.11 | 4.32 | 4.14 | 1.5% | 4.20 | -2.82 | — | -2.82 | ±1.1% |
| 5 | 110 | 0 | 0.11 | 4.24 | 4.08 | 1.5% | 4.14 | -2.39 | — | -2.39 | ±0.8% |
| Average difference of intact systems -1.38 per cent | | | | | | | | | | | |
| Corrected for compensator differences +0.09 per cent | | | | | | | | | | | |
| Average difference when using the same diaphragms -2.61 per cent | | | | | | | | | | | |
| Corrected for compensator differences -1.14 per cent | | | | | | | | | | | |

eter and the distance from target to diaphragm, the two types of diaphragm were found to yield different results. Some measurements made at the same time by the laboratory in Washington, and described below, illustrate this variation.

As dictated by the type of construction, the difference in the distance between the diaphragm and center of the collector for the two chambers amounts to about 15 centimeters, hence the comparatively soft radiation used necessitated corrections for air absorption. These were obtained by interpolation from previous data²⁰.

The final results of the comparisons are summarized in Table III. In giving percentages, the N P L readings are referred as a basis to the guarded field chamber. Runs No 1 and No 2 are straightforward comparisons, Run No 3 was made with the tube diaphragm increased in diameter from 12 to 30 millimeters, and Runs No 4 and No 5 were made with the B S diaphragms on both chambers, hence in this case no diaphragm area corrections of the N P L readings were necessary. This correction for Runs Nos 1-3 amounted to 5.4 per cent as

obtained experimentally. Because of the fact that the diaphragm corrections were unnecessary, the last two runs are probably the most reliable.

The last column, indicating the average deviation from the mean for the observations made with the B S chamber, reveals the effect of the unsteadiness of the X-ray generator, since under the best conditions of operation this average deviation is about ±0.2 per cent.

From these comparisons, we may conclude that the agreement between the chambers alone is probably within the experimental error when using the same diaphragms or correcting for their differences. As the two chambers initially stood, there was a difference of some 9 per cent, which was reduced only by the corrections for air absorption, diaphragms, and compensator differences.

v COMPARISON WITH THE PHYSIKALISCH-TECHNISCHE REICHSDIENSTALT

(With the co-operation of Dr Behnken and Dr Jaeger)

The standard ionization chamber used by the P T R is of the large cylindrical type

²⁰See Footnote 12

described by Behnken²¹ Their X-ray tube is supported vertically in a large lead box (Fig 6) The limiting tube diaphragm is a 3-cm opening in a lead rubber cylinder placed about 5 cm from the tube walls The chamber diaphragm is of the cylindrical type, 7 mm in diameter The collector electrode of the ionization chamber is 30 cm long, with its center approximately 40 cm from the chamber diaphragm A uranium oxide compensator with a null electrometer indicator is used to balance the ionization current²² Their chamber is mounted on a table movable on a track on the floor in a direction parallel to the beam

The B S chamber was mounted on the long optical bench, supported on two tripods, placed at right-angles to the beam and at such a height that the P T R chamber in taking its forward position could pass above it In the operating position the distance from target to chamber diaphragm and the

section of the beam intercepted was the same for both chambers The replacement method of observation was also used here

To check the constancy of the output of the X-ray tube, a thimble chamber was maintained in the beam just off the axis (Fig 6)

The distribution of intensity across the X-ray beam as obtained by the B S chamber is shown in Curve II of Figure 4 The beam is seen to be uniform within experimental limits over a wide area, so that a critical alignment of the chambers was not necessary The working position of both chambers is indicated by the arrows

The diaphragms of the two chambers had the same thickness, so a negligible difference arising therefrom is to be expected This proved to be the case as indicated by some subsequent measurements

The difference in the distances between chamber diaphragm and center of collector for the two chambers was 20 centimeters Comparatively hard radiations, entailing

²¹See Footnote 4

²²R Jaeger, Strahlentherapie, 1920, XXXIII, 542 550

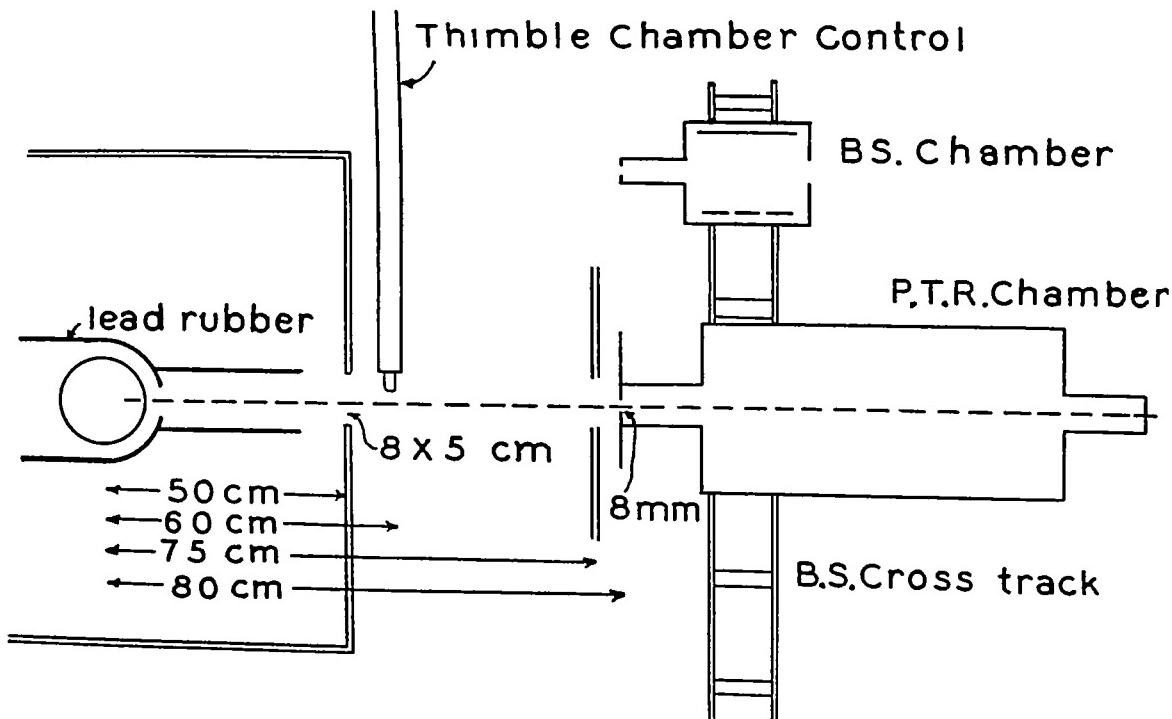


Fig 6 Diagram of X-ray system in Berlin

TABLE IV—COMPARISON OF COMPENSATORS AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

| Uranium oxide current amp $\times 10^{-12}$ | Electrostatic compensator amp $\times 10^{-12}$ | Difference | Average deviation from mean |
|--|--|----------------|-----------------------------|
| 133 | 134.0 | +0.75 per cent | ± 0.31 per cent |
| 206 | 207.1 | +0.53 per cent | ± 0.60 per cent |
| 280 | 281.2 | +0.43 per cent | ± 0.57 per cent |
| | Average +0.58 per cent | | |

TABLE V—COMPARISON WITH THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

| Run | KV | Filter | HVL (mm Cu) | r/min BS | r/min PTR | Air absorption correction | Corrected for air absorption | Per cent difference | BS precision | |
|-----|-----|---------------|----------------|----------|-----------|--------------------------------------|------------------------------|---------------------|---------------------|--|
| 1 | 100 | 20 Al | 0.16 | 0.0515 | 0.0503 | 1.2 per cent | 0.0509 | -1.17 | ± 0.38 per cent | |
| 2 | 150 | 0.5 Cu +10 Al | 0.75 | 0.0457 | 0.0460 | 0.6 per cent | 0.0463 | +1.11 | ± 0.5 per cent | |
| 3 | 180 | 0.7 Cu +10 Al | 1.1 | 0.0476 | 0.0471 | 0.4 per cent | 0.0473 | -0.68 | ± 0.25 per cent | |
| | | | | | | Average -0.25 per cent | | | | |
| | | | | | | Compensator correction -0.6 per cent | | | | |
| | | | | | | Chamber difference +0.35 per cent | | | | |

small air absorption corrections, were used in most of the measurements

The electrostatic and uranium oxide compensators were compared directly in the same manner as with Failla. The results are given in Table IV, referred to the BS compensator as a basis.

The PTR compensator registers a somewhat smaller magnitude than the BS compensator. It will also be noted that the variations are progressive, but in the opposite direction from Failla's. The range of currents in this case is about 1/10 of that used in Failla's laboratory.

The comparison as a whole is given in Table V. The only corrections made were for air absorption in the PTR chamber.

VI COMPARISON WITH FRENCH STANDARD

(At L'Hôpital St. Antoine, with the co-operation of Dr I. Solomon)

At the time of these measurements, the recognized French X-ray standard, measured

in terms of Solomon's unit, was known as the R. This was accomplished with a specific thimble chamber calibrated in terms of the ionization produced by radium under a given set of conditions.²³

Differences in the apparatus, and the general experimental conditions, necessitated a comparison procedure different from that followed with NPL and PTR. A fairly broad X-ray beam was used as a source and measurements made with the two chambers simultaneously in two different parts of the beam. This necessitated placing the Solomon chamber in the beam sufficiently far off the axis so that it did not affect in any way the radiation entering the BS chamber. This position was such that it was impossible to see the thimble chamber when sighting back through the BS diaphragms.

The X-ray tube was placed in a horizontal, oil-filled tank so that the radiation passed through a constant filter of 20 mm

of oil + 10 mm of aluminum. The tube tank was not sufficiently adjustable to provide a horizontal X-ray beam, and, since the B S equipment could not well be used vertically, the beam was brought out at an angle of about 30° with the horizontal. The short optical bench supported by tripods of different heights was inclined at this angle (Fig. 7). The limiting diaphragm was about 3 cm in diameter. The thimble chamber had

an effective length of about 3 cm and was placed 44.5 cm from the X-ray tube target and just off the center of the beam entering the B S chamber. The front diaphragm of the B S chamber was 58.2 cm from the X-ray tube target. As checked later, radiation scattered from the B S chamber did not produce a detectable effect on the thimble chamber readings.

Curve III in Figure 4 shows the distribu-

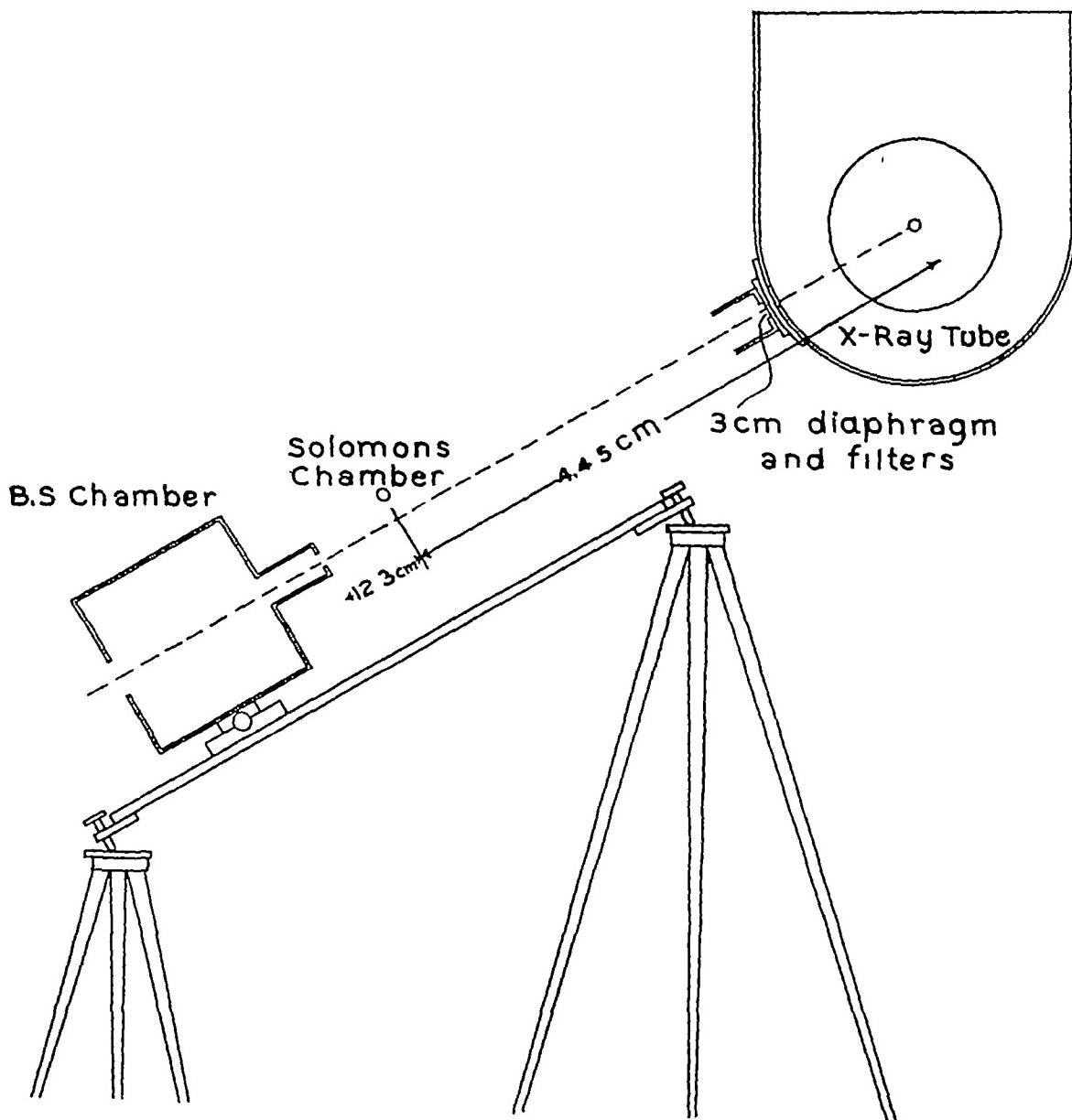


Fig. 7 Diagram of X-ray system in Paris

TABLE VI—COMPARISON WITH DR I SOLOMON AT L'HÔPITAL ST ANTOINE

| Run | K.V | Filter (mm) (+10 Al + 20 mm oil) | Half value layer in copper | r/min BS | R/min Solomon | Corrected for inverse square law | Corrected for leakage | Air absorption correction | Corrected for air absorption | Ratio BS unit/ Sol unit |
|-----|-----|---|----------------------------------|----------|------------------|--|--------------------------|------------------------------|---------------------------------|----------------------------|
| 1 | 110 | 0 | 0.25 | 5.81 | 22.5 | 13.15 | 12.49 | 0.5 per cent | 12.18 | 2.10 |
| 2 | 150 | 0.4 Cu | 0.75 | 3.47 | 14.5 | 8.48 | 8.06 | 1.0 per cent | 7.94 | 2.28 |
| 3 | 190 | 0.5 Cu | 1.0 | 5.85 | 24.8 | 14.50 | 13.77 | 1.5 per cent | 13.63 | 2.29 |
| 4 | 190 | 1.0 Cu | 1.5 | 3.85 | 16.0 | 9.37 | 8.90 | 2.5 per cent | 8.85 | 2.30 |

tion of intensity across the X-ray beam as obtained by the BS chamber. The working positions of both chambers are indicated by the arrows.

Corrections are necessary in this case for the inverse square law and air absorption. The former was applied for the difference in distance of the thimble chamber axis and the front of the BS chamber diaphragm from the target. This required that the readings of the thimble chamber be multiplied by a factor of 0.585. The latter was applied for the distance between thimble chamber and the BS collector electrode—a distance of approximately 26 centimeters. Absorption coefficients were taken from available data. However, as a rough check on these corrections they were also obtained experimentally by moving the thimble chamber in a direction along the beam axis. This could not be done with very great accuracy but the results indicated the corrections used were valid within the experimental limits.

A further correction for temperature and pressure is necessary in this case because the Solomon unit is defined for room temperature. Since the measurements were made at 19°C and 762 mm mercury, a factor of 6.97 per cent was applied to the BS chamber readings. The average deviation from the mean for all the observations was about ± 0.4 per cent.

Table VI gives the results.

It will be noted that for the harder radiation ($HVL = 10$ mm Cu) the Solomon chamber is almost independent of the qual-

ity. However, in going to the softer radiation ($HVL = 0.25$ mm Cu) a change of about 9 per cent apparently takes place. Considering, therefore, only the harder radiation, we find that $1 r = 2.29 R$ as compared with $1 r = 2.2 R$, found earlier by Solomon for the same chamber, which may be counted very good agreement.

As a result of this comparison, Dr Solomon has adopted as his fundamental standard a guarded field ionization chamber identical with that used here.

VII STUDY OF IONIZATION CHAMBER DIAPHRAGMS

(By G Singer, Bureau of Standards)²⁴

The relatively large difference between the effective areas of the chamber diaphragms used by the NPL and BS was unexpected, since earlier ionization measurements at the Bureau of Standards on tapered diaphragms had not indicated any appreciable difference.²⁵ However, if the source of radiation be larger than the diaphragm aperture, some of the radiation incident on the opening strikes the cylindrical wall of the hole in the diaphragm and is effectively cut off (a, Fig. 8). This shifts the effective target-diaphragm position from the outer face toward the inner face of the diaphragm, and

²⁴Washington June 28 1931.

²⁵L S Taylor and G Singer, Bureau of Standards Jour Research (R.P. 169) 1930 IV 631. In reviewing this work it was found that the experimental conditions were not sufficiently like those described above to warrant comparison.

causes an effective shrinking of the diaphragm opening.

The taper diaphragm (*b*, Fig. 8) does not present this difficulty if used far enough from the target to prevent radiation hitting

roughly 12 per cent. The diaphragm *B* was the same as those used on the BS chamber in Europe, having a taper of 0.02 mm per mm on the radius and a thickness of 4 mm up to the bevel. Diaphragm *B*,

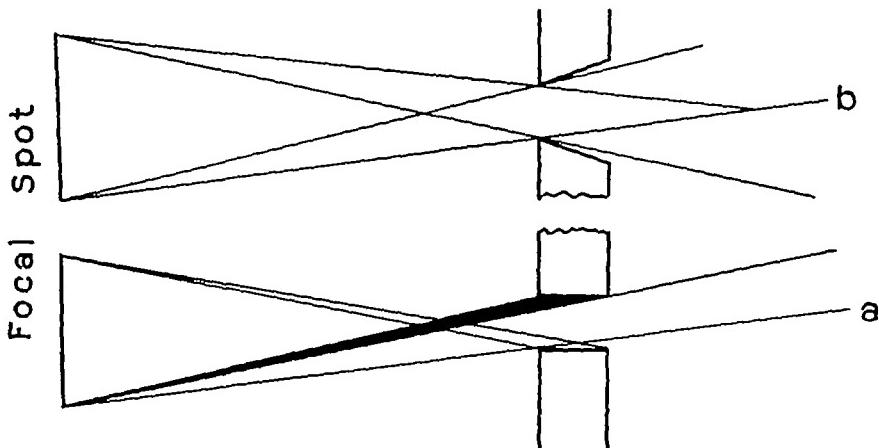


Fig. 8 Effect of thick and tapered diaphragms

the wall of the aperture. It has the disadvantage, however, of introducing arbitrary factors in the diaphragming system. Furthermore, with steep tapers, the front edge of the diaphragm may actually transmit some radiation.

As a result of the discrepancy between the NPL and BS measurements, three carefully constructed diaphragms of the types shown in Figure 5, *A*, *C*, *D*, were compared at the Bureau of Standards. These were used successively on the ionization chamber at a distance of 100 cm from the target and ionization measurements made for the same X-ray output.

The actual measurements of the diaphragms are given in Table VII. Diaphragms *A* and *C* were both drilled and reamed without taper in lead-bismuth plates 10 mm thick, *C* then being beveled off at the back to give a resultant thickness of 4 millimeters.²⁶ From the explanation given above they should differ in transmission by

at a distance of 100 cm from the target, should transmit all the radiation incident on the front of the aperture, and, neglecting transmission through its edges, should pass approximately 0.4 per cent more radiation than the thin straight-walled diaphragm *C*. The diaphragm *D* had about two and one-half times the taper of *B* and was used in these measurements solely to bring out more clearly the effect of the tapered walls.

To compare the effective areas or transmissions of these diaphragms, the volume of air ionized within the chamber is calculated from the measurements of the diaphragm diameter, and from this in turn is determined the ionization per cubic centimeter (I_{cc}) of air.²⁷ I_{cc} is, of course, directly proportional to the effective diaphragm opening. The results are given in Table VIII.

The diaphragm *C* (thin, straight walls) is used as a base in the experimental and calculated values of I_{cc} , both being taken as 100. The agreement between the two sets of

²⁶This type of diaphragm has always been used in previous experiments at the Bureau of Standards.

²⁷L. S. Taylor, Bureau of Standards Jour. Research

TABLE VII—DIAMETER MEASUREMENTS OF LEAD-BISMUTH ALLOY DIAPHRAGMS
MADE BY BUREAU OF STANDARDS GAGE SECTION

| Diaphragm | Microscope | | | Plug gage (mm) | Adopted value (mm) |
|-----------|--------------------|--------------------|--------------------|----------------|--------------------|
| | Front face (mm) | Back face (mm) | Mean (mm) | | |
| A | 8.041 | 8.037 | 8.042 | 8.024 | 8.033 |
| | 8.046 | 8.043 | ----- | ----- | ----- |
| B | 7.993 ¹ | 8.159 ¹ | 7.993 ² | ----- | 7.993 |
| | 8.038 | 8.044 | 8.038 | 8.016 | 8.027 |
| C | 8.028 | 8.039 | ----- | ----- | ----- |
| | 8.032 | 8.376 | 8.040 ² | 8.034 | 8.037 |
| D | 8.047 | 8.379 | ----- | ----- | ----- |
| | 8.005 | 8.170 | 8.005 ² | ----- | 8.005 |

¹Average of readings taken for 6 diameters

²Average for diameter of front face

Measurements made by Binks in Teddington. It will be noted that they differ from our measurements by only 0.15 per cent

TABLE VIII—COMPARATIVE IONIZATIONS PER CUBIC CENTIMETER OF AIR
OBTAINED WITH DIFFERENT DIAPHRAGMS 100 CM FROM TARGET

| Diagram | I/c.c. (Exp.) | I/c.c. (Calc.) | Observational error |
|---------|---------------|----------------|---------------------|
| A | 98.6 | 98.8 | ±0.17% |
| B | 100.31 | 100.4 | ±0.20% |
| C | 100.0 | 100.0 | ±0.17% |
| D | 100.79 | ----- | ±0.17% |

values is as close as may be expected. It is seen, however, that the difference between A and B is only 1.7 per cent, whereas, at the NPL, the experimentally determined difference between essentially similar diaphragms was apparently 5.4 per cent. A possible cause of this discrepancy may lie in errors in the measurements of the diaphragms as shown below.

The accurate measurement of the diameters of the apertures presented some unexpected difficulties. The BS tapered diaphragms were measured by a method de-

scribed by Failla²⁸ in which an accurately known tapered mandrel was forced a given distance into the lead-bismuth diaphragm. Binks measured two of our diaphragms while we were at Teddington, with a micrometer microscope, and found diameters of 8.005 and 8.035 mm., respectively, whereas, they were both supposed, from mandrel measurements, to be 8.000 millimeters.

To check the reliability of the microscope

or other methods, the diaphragms *A*, *B*, *C*, *D*, in Figure 5, were measured by the Gage Section of the Bureau of Standards,²⁹ using both the micrometer-microscope and plug-gage methods. Diaphragm *B* is the same one measured by Binks. The results given in Table VII show that the micrometer-microscope measurements are consistently larger than the plug-gage measurements. An explanation for this discrepancy is at once obvious from an exaggerated cross-sec-

VIII CONCLUSION — JOINT RECOMMENDATIONS OF THE BUREAU OF STANDARDS, NATIONAL PHYSICAL LABORATORY, AND PHYSIKALISCH-TECHNISCHE REICH-SANSTALT, AND LE SERVICE D'ÉTALONNAGE DE L'HÔPITAL ST ANTOINE

Table IX is given to summarize the results of all the comparisons. The size of the roentgen as measured by each laboratory

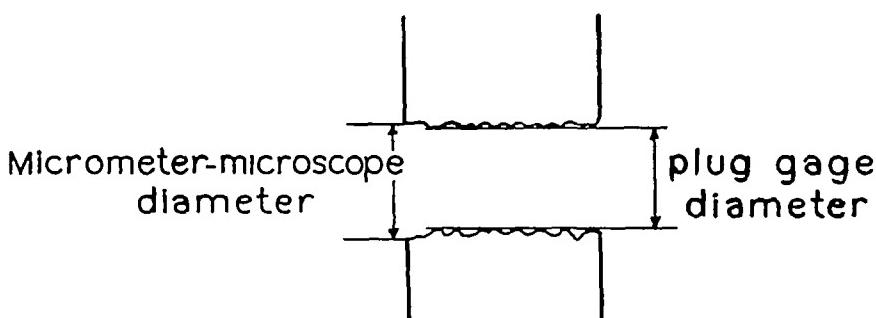


Fig. 9 Magnified cross-section of diaphragm showing where diameter measurements apply

tion of a diaphragm in Figure 9. The microscope method measures only the face diameter of the hole, which is likely to be somewhat beveled or worn in the process of making. The plug-gage, on the other hand, measures the diametral separation between the highest projecting ridges within the bore. The diameters used in the present study were the average from the two sets of measurements and are estimated by the Gage Section to be in error by not more than 1/10 per cent.

It should be mentioned that even when using hard lead it was found impossible to make circular holes. Warping tended invariably to make elliptically shaped openings. As a consequence, the Bureau is discontinuing the use of lead diaphragms and will in the future use a hard gold or lead-calcium alloy the surface of which can be accurately lapped and may be relied upon to hold its dimensions.

²⁹We are indebted to Dr. I. V. Judson and Dr. D. R. Miller of the Bureau of Standards Gage Section for their willing co-operation in this work.

is referred to that measured by the B S chamber as a base

Thus the agreement among the national laboratories is as close as may be reasonably expected and much better than necessary today for practical calibration purposes.

The national laboratories feel justified therefore, in making certain recommendations which should be met by all open-air ionization chambers in order to avoid gross errors. It is believed that these are neither restrictive nor unduly arbitrary. They are

1. The use of an X-ray tube having a focal spot as small as possible (up to 8 mm diameter)

2. The use of a diaphragm placed as close to the tube as possible and having an aperture of such size as to shield from the ionization chamber all radiation except that from the face of the target

3. The use of a standard chamber diaphragm having a minimum thickness but such that not more than 1/10 of the radia-

TABLE IX —SUMMARY OF COMPARISONS MADE AMONG THE BUREAU OF STANDARDS AND FOREIGN LABORATORIES

| Laboratory | Tube voltage (K.V.) | HVL (mm copper) | Size of unit (No of units per B S unit) | Error in comparisons |
|--------------------------|---------------------|-----------------|---|----------------------|
| B S large chamber | 100-170 | 0.1-1.1 | 1.0005 | +0.25 per cent |
| N P L ¹ | 110-140 | 0.11-0.5 | 1.001 | +0.9 per cent |
| N P L ² | 110-140 | 0.11 | 0.9886 | +0.9 per cent |
| N P L ³ | 110-140 | 0.11-0.5 | 0.996 | - |
| P T R. | 100-180 | 0.16-1.1 | 1.0035 | +0.4 per cent |
| Solomon | 110 | 0.25 | 2.10 | +0.4 per cent |
| Solomon | 150-190 | 0.75-1.5 | 2.29 | +0.4 per cent |

¹Corrections made for diaphragm differences

²Some diaphragm used on both chambers

³Averaging all readings taken

tion measured passes through the material of the diaphragm

4 The use of a standard ionization chamber aperture of about the same diameter as the focal spot, however, not to be much smaller

5 The utilization of only that portion of the X-ray beam in which the intensity within the experimental limits is uniform

6 The use of the shortest distance between chamber diaphragm and collector electrode

7 The use of a current measuring method wherein the potential difference between the guards and collector plate is negligible, preferably a null method

Dr Solomon has announced³⁰ his acceptance of the open-air ionization chamber as

his fundamental standard, while at the same time recognizing the secondary calibration with radium as heretofore used by him. For this purpose he will employ an exact duplicate of the Bureau of Standards' guarded field ionization chamber as used in this investigation.

In conclusion, the author wishes to express his appreciation to the following persons whose wholehearted efforts and assistance have rendered this work possible in its entirety. Messrs Singer and Stoneburner, of the Bureau's X-ray Laboratory, for having carried out most of the preliminary tests and measurements, Mr Rhinebold, of our Instrument Shop, who constructed all of the apparatus, and those investigators in the foreign laboratories whose names have already been mentioned and whose complete co-operation was essential and forthcoming.

³⁰Proceedings of Committee on X ray Units of Third International Congress of Radiology (unpublished)

MEDICO-LEGAL DEPARTMENT

AN IMPORTANT DECISION (WITH SOME PECULIAR ASPECTS)

Roentgen injury during fluoroscopy (Nelson vs Newell (Wis), 217 N.W.R. 723) — This action was brought for malpractice to recover damages from the defendant physician, for alleged negligent and unskillful application of the roentgen rays in such a manner as to produce what was alleged to be a third degree roentgen dermatitis. The alleged injury was the result of diagnostic application (fluoroscopy) of the roentgen rays by the defendant in this case and the subsequent application of the same agent seventeen days later by another radiologist, who, however, was not blamed by the plaintiff, nor included in the action for damages.

The issue was submitted to a jury in the Circuit Court of Racine County (Wis), a verdict was rendered in favor of the plaintiff, and the sum of \$12,500.00 damages was assessed.

Some of the testimony in the case, particularly that of the plaintiff in the case and that of a layman who had been called in as an expert witness, was decidedly fanciful and certainly contrary to established and recognized facts. The testimony of these witnesses unquestionably had considerable weight with the jury and, because the same testimony is quoted in the decision of the Supreme Court, must have had considerable weight with even those learned and erudite jurists.

The case was appealed to the Supreme Court of the State (Wisconsin) and the judgment of the lower court was affirmed. The complete opinion is as follows:

The defendant denies negligence in his answer, and alleged as a defense that the plaintiff was either hypersensitive to the X-ray, or that the burn was due to the cumulative effect of the X-ray, in an examination made by another doctor about seventeen days

subsequent to the X-ray examination by the defendant. The object of an X-ray examination and the manner of the operation of the machine are quite generally known, and have been described to a considerable degree in detail in the cases involving malpractice of physicians based on the X-ray examination or treatment, so that no further explanation herein will be attempted.

On the morning of May 10, 1924, the plaintiff called at the defendant's office in order to ascertain, by the use of a fluoroscope, the cause of his apparent ill health. He was subjected to two examinations, one in the morning between the hours of 9 and 10 and one in the afternoon of the same day. The defendant testified that in the use of the fluoroscope he applied the usual and standard dose for the purposes of an examination. Plaintiff testified that after the second examination he experienced, while returning to his home, an itching sensation in the small of his back, which became more aggravated from that time until the fourth or fifth day thereafter, at which time the place where the X-ray was applied manifested an area of redness in the form of an oblong, that the itching thereafter continued, and that, seventeen days after this examination by the defendant, he called at the office of one Dr Fortier, an X-ray specialist, of Milwaukee, where three X-ray pictures were taken, the X-ray being applied to the front of his body. Dr Fortier was not informed at that time of the examinations made by the defendant.

On or about October 1, 1924, it became apparent that the plaintiff suffered from ulcers in the region of his back where the defendant applied the X-ray, and it is undisputed in the case that the ulcers so appearing manifested a third degree burn. There is also testimony that the ordinary and usual application of the X-ray for purposes of a fluoroscopic examination consists of a dose equivalent to 1/20 of

what is known as an erythema dose, and that an erythema dose is sufficient to create an area of redness at or around the place where the X-ray is applied. Defendant's experts testified that they had never heard of a manifestation of itching within several hours of the examination, that it occurred as a rule between 10 and 12 days after the examination, that an appearance of redness 4 or 5 days after the examination is also unusual.

In many of the cases of malpractice in which it is charged that the physician had caused the injury by the negligent use of the radiograph in fluoroscopic examinations, or by an overdose of the X-ray, or by the application of the X-ray for an excessive length of time, the defense is interposed, as in the instant case, that the patient is abnormal and hypersensitive to the X-ray treatment, and this defense has proved itself quite generally successful. It also appears in the evidence that no method has been discovered by means of which it can be determined if a given subject is hypersensitive to the X-ray. It is undisputed that cases of hypersensitivity are extremely rare, that an X-ray burn of the third degree constitutes a serious injury, and may result in permanent injury, that a third degree burn caused by an X-ray destroys the skin and the deeper tissues of the body and also the blood vessels, and that an operation or operations connected with such an injury are extremely painful.

Dr Dorr, one of the defendant's experts, testified that he had performed in the neighborhood of 10,000 X-ray examinations of the chest, and numerous other examinations with respect to other parts of the body, that he had in many instances applied the ordinary X-ray doses to infants within an hour after their birth, and that he had never in his practice produced a third degree X-ray burn. Dr Epperson, also a witness for the defense, confirmed as to his practice Dr Dorr's experience, but his practice covered in the neighborhood of 25,000 cases. Dr Perry, the expert for the plaintiff, testified that after an examination of the plaintiff's back shortly before the trial, he was convinced that the injury constituted a third degree X-ray burn. A hypothetical

question put by counsel to Dr Perry, including substantially all of the facts shown in the evidence, elicited the answer that he knew that the burn was caused by an excessive or improper application of the X-ray, and that in his opinion the injury resulted therefrom.

The ordinary and standard dose, according to the testimony of the defendant, was applied in the instant case. Such a dose consists of 1/20 of an erythema dose. Dr Perry also testified that in order to produce a third degree burn it would be necessary to use at least one and one-half or double an erythema dose. The jury had a right to believe this testimony of Dr Perry, and, assuming it to be true, it will become apparent even to the mind of a layman that the use of the standard dose for examination purposes leaves an enormous factor for safety.

Absolute certainty that the injury resulted from negligence is not required in the law. Even in criminal cases, the rule is that, where a jury is satisfied beyond a reasonable doubt, the verdict of the jury will not be disturbed. In civil cases, the rule requires proof which satisfies the mind of the jury to a reasonable certainty. In this connection, therefore, if we consider the testimony of the defendant's experts, Dr Dorr and Dr Epperson, and in view of all of the other testimony in the case, the overwhelming probability supports the finding of the jury herein and the judgment of the court.

If a verdict such as was rendered in the instant case upon the evidence adduced therein can be set aside upon the ground of a mere speculation that the subject is one who possesses a hypersensitivity to the X-ray, then it might be admitted that cases of this kind cannot be successfully prosecuted. The use of the X-ray in a physician's practice in modern times has become almost indispensable. Its importance cannot be overestimated. It is used in connection with all classes of injuries and it proved of inestimable value to mankind during the recent war. The X-ray apparatus has been improved from the time of its invention, so that it has now acquired not only a remarkable degree of efficiency, but also of reliability. But, conceding the tre-

mendous value of the X-ray, it must also be admitted that the improper and negligent use thereof may result in injuries and suffering which are appalling, and notwithstanding the efficacy of this remedy, the welfare of mankind requires that a physician who operates an X-ray machine is under duty to exercise a degree of care, diligence, judgment, and skill which physicians in good standing in the same school of medicine usually exercise in the same or similar localities under like circumstances, having regard to the advanced state of medical and surgical science at the time the physician discharges his legal duty to the patient *Kuehnemann vs Boyd (Wis.)*, 214 N W R 326

Seventeen days after plaintiff's visit to the defendant, he had three X-ray pictures taken by Dr Fortier, of Milwaukee. It is claimed that the injury results from the cumulative effect of the X-ray. The testimony shows that the ray applied in Dr Fortier's office was merely for examination purposes, and not for treatment, and that it was applied on the front of his body, while the patient (plaintiff) was reclining. Mr McIntosh testified in general that there is a possibility for an X-ray burn to appear on the back, where the ray is applied in the front, but that ordinarily the burn would make itself manifest at the point of application of the ray.

In this case it appeared that the itching sensation was manifested about two hours after the final treatment by the defendant, while ordinarily such a manifestation does not occur before 10 or 12 days thereafter. It continued for a long period thereafter, and became more aggravated as time went on. Furthermore, the redness of the skin appeared between four and five days after the visit to the defendant, and it appears that such a manifestation ordinarily does not appear before the expiration of from ten days to two weeks. This, in connection with the testimony of defendant's expert, McIntosh, that the burn ordinarily appears at the point where the X-ray enters the body, and the opinion evidence of Dr Perry, plaintiff's expert, establishes the basis for a logical conclusion that the burn

resulted from the negligent application of the X-ray by the defendant.

Defendant's counsel assign as error the giving by the court of the following instruction:

"You are instructed that the fact that a bad result following the treatment, if you find such was the fact from a consideration of all the credible evidence in the case, is not alone sufficient to charge the defendant with negligence. You are therefore not at liberty to conclude that the defendant was guilty of negligence or malpractice from the mere fact that bad results follow the treatment, *although that fact may be considered, together with all the other evidence, in reaching your conclusion*. The defendant cannot be held liable unless you are satisfied by a preponderance of all the credible evidence in the case, to a reasonable certainty, that he failed to use that skill and care which I have already mentioned and instructed you it was his duty and obligation to exercise in his treatment of the plaintiff and that such failure to exercise such care, if you find that he so failed, proximately caused injuries to the plaintiff."

That this instruction constituted error appears from the holdings of this court in the cases of *Kuehnemann vs Boyd (Wis.)*, 214 N W R 326, and *Rost vs Roberts*, 180 Wis., 207, 192 N W R 38. We do not consider this case as a close one, and therefore conclude that the error is not prejudicial, under the provisions of the Statutes.

Error is also assigned upon the ground that the damages awarded are excessive. We have carefully reviewed the evidence, and in view of the actual loss of time, the seriousness of the injury, and the pain and suffering of the plaintiff, we are satisfied that the amount awarded is supported by the evidence.

OTHER CASES REPORTED

Slander of Physician (Amick vs Montross (Iowa), 220 N H R 51) — The plaintiff, a licensed physician, sued the defendant for slander. He alleged, among other things, that the defendant maliciously and untruthfully said to Dr M in the presence of Dr S, "I heard Doc A was drunk that night and wasn't able to go, was the reason

you were called" This statement was made, the plaintiff asserted, in connection with a confinement case, for the purpose of injuring his business and reputation On motion of the defendant, the statement was withdrawn from consideration by the jury, on the theory that it was not actionable *per se* (that is, in and of itself and without proof of actual damage) and that on the entire record there was nothing, so far as this charge was concerned, to be submitted to the jury From a decision in the trial court, the plaintiff appealed to the Supreme Court of Iowa He contended that the language stated was actionable *per se*, because it charged him with drunkenness, and drunkenness was a crime, and also because the language was prejudicial to him in his profession The Supreme Court concluded that, under the laws of Iowa, drunkenness was not such a crime as would make an allegation of drunkenness against a person actionable *per se* The court held, however, that the language used by the defendant was prejudicial to the plaintiff in his profession and for that reason was actionable *per se* It is true, said the Court, that the language used does not charge the plaintiff with any lack of professional knowledge or skill, or misconduct in the plaintiff's professional capacity, or any impropriety in treatment It does charge, however, in substance, that at a time when a doctor was needed the plaintiff was drunk and unable to render medical service and attention Said the Court

A lawyer, a banker, a merchant, and men engaged in many other occupations have regular business hours A physician's occupation differs therefrom Sickness and accidents occur at any hour of the day or night The emergency may happen at any minute, when the services of a doctor will be needed The doctor is engaged in the practice of his profession every hour of the day To say of a physician, in substance, that he was drunk and unable to attend upon a call, reflects upon his

professional character One would not be likely to call a doctor in case of sickness, accident, or emergency if there were any probable cause for believing that he would be found in a state of drunkenness Such a charge "necessarily must, or presumably will as its natural and proximate consequence, occasion him pecuniary loss"

The Supreme Court held, therefore, that as there was sufficient evidence to prove the making of the statement complained of, the trial court was in error in withdrawing it from the jury

The defendant pleaded in mitigation of the damages the general bad reputation of the plaintiff, as a physician and surgeon and doctor in the town of M_____ and vicinity Over the plaintiff's objection, he was allowed to introduce evidence to support this plea The plaintiff, on appeal, contended that this was error, because the language complained of was uttered by the defendant, at N____E____, and the evidence adduced by the defendant should have been limited to evidence of the plaintiff's general reputation in that community It appeared, however, that the distance between the two communities was only eight miles The evidence received, said the court, was in exact conformity with the defendant's plea of mitigation and was properly admitted

Because the trial court withdrew from the jury that count in the plaintiff's complaint based on the charge of drunkenness, the judgment of the court below was reversed and the cause remanded

Ethics Collusion between Physician and Lawyer Justifying Disbarment (In re Burke (N.Y.), 237 N.Y.S. 53)—In order to secure payment of his bills for professional services a physician recommended personal injury cases to a lawyer Payment in such cases was contingent on the results This arrangement violated the ethics of the legal and medical professions and was likely to lead to false testimony as to the nature of

the injuries. The lawyer was suspended from practice for two years.

Opinion Based on Absent Roentgenogram is Inadmissible as Evidence (People vs Williams (Ill.), 169 N.E.R. 190)—In a prosecution for murder, a coroner's physician testified that he examined the body after death, that a roentgenogram showed that the bullet passed from the left to the right side of the body, shattering the ninth rib and the spinal cord, and that he viewed the body only and took the records from the hospital, but made no autopsy. He admitted that there was doubt as to the cause of death, but he stated that in his opinion death was due to heart disease, superinduced by nephritis, an infection of the kidneys, and an inflammation of the bladder, due primarily to the cutting of the spinal cord by the gunshot wound. No objection was made to the admission of this testimony when it was offered. On cross-examination, however, when the witness admitted that he had made no postmortem examination of the body and that he obtained his information as to the cause of death from the records of the hospital, counsel for the defendant moved to strike out his testimony with reference to the cause of death. The court did not rule directly on the motion but said that the witness might testify as to what he saw and remembered about the roentgenogram, which was "simply a physical thing." The roentgenogram was not introduced in evidence nor in any way identified, nor did the witness qualify as an expert in the reading of roentgenograms. The defendant was convicted and thereupon appealed to the Supreme Court of Illinois.

The testimony of the coroner's physician, said the Supreme Court, when given from the records of a hospital without proof of their authenticity, was clearly inadmissible as hearsay, and should have been stricken out. His testimony concerning matters disclosed by the roentgenogram was likewise inadmissible because no ground had been

laid for such testimony. The rule in regard to the use of roentgenograms, when it is sought to put them in evidence, requires that the witness testify either that the roentgenogram shows accurately what the witness saw by examining the body through a fluoroscope, or that the witness is skilled in the use of the roentgen machine, that he took the roentgenogram concerning which he testifies, and that he is able to say that it is accurate. It was clearly error to permit the witness to testify, giving his conclusions as to what the roentgenogram showed, without proof of his qualifications and of the accuracy of the roentgenogram, and without accounting for failure to produce it. There was no proof of the cause of death, other than the testimony of this witness. As such proof rested on incompetent testimony, its admission was an error requiring the reversal of the judgment.

Workmen's Compensation Acts Liability of Physician for Malpractice (McDonough vs National Hospital Assn (Ore.), 294 P.R. 351)—The Oregon workmen's compensation act provides that a workman injured in the course of his employment by the negligence or fault of a third party has a choice of remedies. He may proceed under the statute to obtain an award of compensation or he may proceed against the third party at common law, but he cannot do both. Having pursued one remedy, he is barred from subsequently invoking the other, if he elects to take under the act, he must assign his cause of action against the third party to the commission, for the benefit of the accident fund. An aggravation of the primary injury resulting from the mistake, negligence, or malpractice of a physician in treating the original injury is compensable under the act. Once having received and accepted compensation for the combined injuries, the employee cannot maintain an action against the physician for malpractice.

Libel Report of Examining Physicians Appointed by Court (Mickens vs Davis (Kan.), 294 P R 896)—The written report of physicians appointed by a court to make a physical examination of a party to an action in that court constitutes a privileged communication and cannot be made the basis for an action for damages for libel. In this case the plaintiff had obtained a judgment in the District Court of Douglas County against his employer under the workmen's compensation act of Kansas. Subsequently the District Court appointed the defendants, physicians and surgeons, to examine the plaintiff to determine whether his disability was still existing and whether it was permanent or partial. They were instructed to report the result of their examination to the court. The defendants reported, among other things, "that the cause of plaintiff's injury was a spinal lesion apparently due to syphilis, and that same was a progressive lesion, and that he, the plaintiff, would probably never be better than he is now."

Thereupon the plaintiff sued the defendants for libel. The Supreme Court of Kansas held that the report was privileged and that the plaintiff could not base an action for libel on it.

Chiropractic Treatment must be Limited to Manipulation (Heintze vs New Jersey State Board of Medical Examiners (N J), 153 Atl R 253)—The appellant, Heintze, was licensed to practise chiropractic in New Jersey under Chapter 4, Laws of 1920, which apparently authorized chiropractors to treat human ailments by manipulation only.

Heintze, however, used a vibrator, an electric light, and the galvanic current. His assistant, in his presence, gave directions for a vegetarian diet and the use of flaxseed tea. "That such practice does not constitute the practice of chiropractic," said the Supreme Court of New Jersey, "but does constitute the practice of medicine and surgery, seems entirely plain." The Medical Practice Act of New Jersey is not unconstitutional because it provides for a trial without a jury of persons charged with practising medicine and surgery without licenses. The judgment of the trial court, convicting Heintze of practising medicine and surgery without a license, was affirmed.

Note—Here is a fine decision for our New Jersey colleagues at least and for physiotherapists in general. *Diet, radiation, and electric treatment constitute the practice of medicine*

—I S T

CASE REPORTS AND NEW DEVICES

A CASE OF PULMONARY FIBROSIS OF OBSCURE ETIOLOGY, WITH BILATERAL SPONTANEOUS PNEUMOTHORAX¹

By MAJOR ALBERT BOWEN, MC, U S A,
HONOLULU, T H

This is a rather unusual case which has considerable interest from the viewpoint of roentgen diagnosis and as a curiosity presenting multiple, bilateral, spontaneous pneumothoraces with absorption and apparent cessation of the latter.

The patient, C S, aged 25 years, enlisted in the Army in March, 1925. For a short time he worked in an open stone quarry. In May, 1925, he began to have diarrhea with from 10 to 20 bloody stools a day, which has continued with slight occasional improvement up to the present. Soon after the onset of the colitis, he began to have pain in the chest, with productive cough and shortness of breath. In addition, he had pain and soreness in the lower abdomen, fever up to 102°, chills, with night sweats, and loss of weight. Later, he developed skin lesions which were shallow, indolent ulcers with much itching and secondary infection due to scratching. The patient was treated in the local station hospital before being sent to Walter Reed General Hospital for study and treatment.

Examination at the latter hospital showed a flat chest, with abdominal breathing, some dullness and fine as well as coarse, moist râles over the entire chest persisting after coughing. The lower abdomen was tender. There were internal and external hemorrhoids.

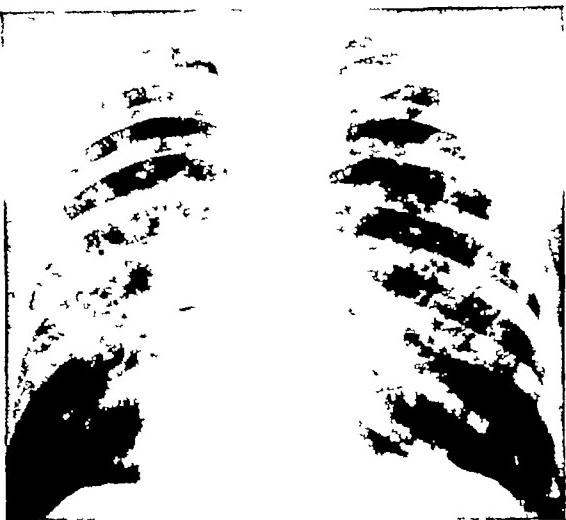


Fig 1 Before pneumothorax, showing extensive interstitial fibrosis

X-ray examination of the chest showed that in both lungs, from the first to the fifth ribs, anteriorly, there was a fine mottling, symmetrically distributed. Linear markings were thickened and the hilus shadows were prominent. The impression was of probable pneumonoconiosis, with tuberculosis to be considered. The gastro-intestinal series was essentially negative.

Sigmoidoscopic examination showed many superficial ulcers, with submucosal hemorrhages extending down to the rectum. Diagnosis was ulcerative colitis.

Sinus examination showed positive maxillary antra, which were treated. There was much dental work done to clean up the mouth and the tonsils were removed. Examinations for tubercle bacilli and parasites were consistently negative.

The patient showed some improvement and gained ten pounds during a stay of fourteen months at Walter Reed Hospital. Among the many things tried he was treat-

¹Published with the consent of the Surgeon General of the Army who assumes no responsibility for any statement contained therein.



Fig 2. After spontaneous pneumothorax on the right side.



Fig 3. Bilateral pneumothorax, more extensive on the left side.

ed by emetin and vaccines, but no form of treatment helped very much.

He was discharged from the Army for disability, later going to the Soldiers' Home Hospital. In 1928, he went to New Mexico, where he tried to work, but, becoming worse again, he returned to the Soldiers' Home.

In November, 1930, he was transferred to Fitzsimons General Hospital for observation for tuberculous enteritis. On admission, the patient was having from ten to fifteen bowel movements a day, some pain in the chest, but no cough or sputum. At this time, the fingers were clubbed, there were healing furuncles on the right shoulder, and the chest had râles and increased dullness to percussion. X-ray examination (Fig 1) showed very heavy, bilateral, interstitial fibrosis, with some emphysema at the peripheries. Laboratory studies from stools, sputum, and scrapings from ulcers were negative for tuberculosis, fungi and parasites. A course of potassium iodide produced no change in the patient's condition.

On Jan 15, 1931, the patient had sudden pain in the right chest with a feeling of full-

ness, but not much embarrassment. X-ray examination showed a moderate pneumothorax on the right side, with emphysematous blebs on the periphery. It was believed that a bleb had ruptured and that the fibrosed lung had prevented complete collapse (Fig 2). February 5, following a severe coughing spell, the patient had pain in the left chest, cyanosis, and shortness of breath. Three hundred c.c. of air were drawn off. X-ray examination showed bilateral pneumothorax (Fig 3). On February 17, there was another similar attack on the right side, and X-ray films showed an increase in the pneumothorax. At this time, 200 c.c. of air were withdrawn. On March 3, there was sharp sudden pain on the left side, with dyspnea and cyanosis. X-ray examination showed an increase of air in the left lung. X-ray films made on March 8 showed some fluid and pleurisy on the left side. On March 22, there was acute pain in the left chest, respiratory embarrassment, heart to right. One thousand c.c. of air were withdrawn. Another spontaneous pneumothorax occurred on the right side on April 3 but with fewer symptoms. Spon-

Spontaneous pneumothorax occurred on the left side on April 28, accompanied by less severe symptoms.

That the patient did not develop empyema with these many lung ruptures is probably due to the fact that the ruptures were at the extreme periphery, distant from large bronchi.

The emphysematous blebs contained little or no fluid and did not discharge infected material into the pleura. Although the blebs collapsed, the point of rupture remained like a valve and probably continued to force air into the pleura for several days, when there was coughing or forced inspiration. This may account for the delay in absorption of the air.

Later chest examinations showed the air being absorbed in both sides, with considerable pleural reaction. Both lungs gradually re-expanded and the patient has since had no more spontaneous pneumothoraces. It is believed that generalized pleural adhesions formed which hold the lung to the parietal pleura and prevent rupture of the blebs and collapse. The fibrosis has gradually increased.

Repeated microscopic and cultural studies of scrapings from ulcers on skin and sigmoid and of sputum continued to be negative except for two different fungous growths which were believed to be air contaminations.

On Sept 16, 1931, the patient left the hospital, his condition not much changed from that found on admission. The diagnosis was (1) Colitis, chronic, ulcerative, cause undetermined, (2) Interstitial fibrosis of both lungs cause undetermined, (3) Multiple, spontaneous, bilateral pneumothorax, due to the fibrosis.

We shall be glad to receive comments on the etiology from any who have had similar cases. Our impression is that it is of mycotic origin in spite of the continued negative findings.

THE RADIOGRAPHIC DETECTION OF THE CATFISH SPUR AS A FOREIGN BODY

By ROBERT B TAFT, M.D., B.S.,
CHARLESTON, S.C.

Some time ago I was asked to attempt the radiographic determination of a foreign body of a rather unusual nature. This foreign body was supposed to have been the spur of a catfish.¹ Being unfamiliar with the composition of this spur, I secured one and was rather surprised to find it dense enough to cast an excellent shadow through the flesh or bones of a man's foot. As the wounds from this fish are of frequent occurrence in this region, I felt that the matter might be of some interest.

The catfish is often caught by those who fish along the beaches of the South Carolina coast and since it is not regarded as edible except by the colored people, it is felt to be a nuisance and is left to die on the shore, where it is frequently stepped upon. The

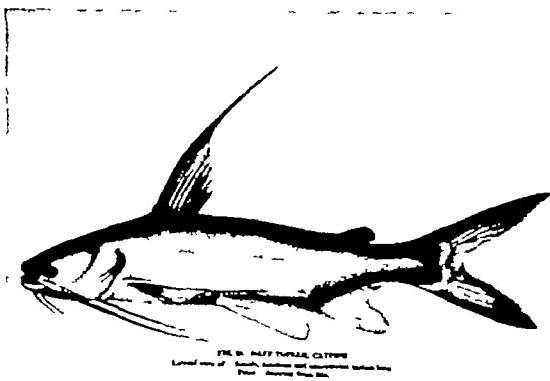


Fig 1. The sea catfish, copied from an illustration by Gruber, "Zoologica," Vol II, No 5

¹This is a summary of the article which appeared in "Zoologica," August, 1916. "The Gaff Topsail A Sea Catfish that Carries its Eggs in its Mouth." The Gaff Topsail Catfish (*Felichthys felis*) is a subtropical form ranging as far north as Cape Cod but is especially common along the coasts of Florida and the Indian River. From Thomas Ash's "Carolina" comes the following description of it: "Catfish whose head and glaring eyes resemble a Cat; it's esteemed a very good fish, it hath a sharp thorny Bone on its Back, which strikes at such as endeavor to take it; which by seamen is held venomous. The male incubates the eggs in his mouth not only until they are hatched but until the young are able to take care of themselves. The largest number taken from the mouth of one male was 55."

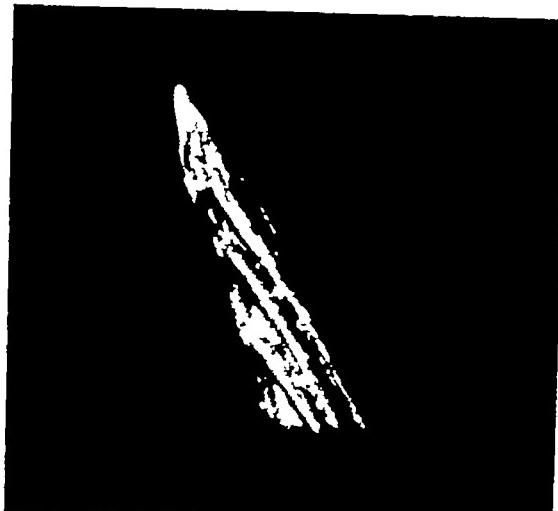


Fig 2 The spur of the catfish magnified about 20 diameters



Fig 3 The spur superimposed on an adult foot showing the density. The actual fragment reported in this paper is too small to permit of reproduction in an illustration

spur (Figs 1 and 2) has a number of barbs which make it very difficult of withdrawal from the wound and there is some chance that small fragments may be broken off. While it is commonly believed that the slime from this fish is poisonous, there is no real foundation to that idea, but at least the wound gives pain out of all proportion to a clean wound.

In this particular instance a woman stepped on a catfish which had been recently caught. The spur penetrated through the sole of her shoe, obliquely through the second toe, and into the great toe. The spur was examined by some one in the party and pronounced whole but it is doubtful if the examination was very carefully made.

For about five days the patient was able to walk, but with difficulty, following which the pain became so severe that she had to remain in bed for a week. Discharge continued from the wound for about one month.

A radiographic examination made about two weeks after the injury showed a minute foreign body in the soft tissue of the great toe, just medial to the base of the proximal phalanx. This body, which was triangular in shape, was seen in the same position on five

films of different densities. It seems reasonable to believe that this was the point of the spur. No attempt was made to remove the fragment, as it could hardly have been found. Another series of films made two months later showed that it had disappeared, either by discharge from the wound or absorption. This piece of spur was so small that it could not be reproduced in a magazine illustration, so a similar spur was procured, placed beneath a foot, and a test film made. This spur which is shown in Figure 3, is seen to be quite dense, showing well through the metatarsal bones.

This case is reported because, so far as I know, no mention has been made of a similar one in any previous writings.

I am indebted to Mr E Milby Burton, Acting Director of the Charleston Museum, for the information about this fish.

LYMPHOBLASTOMA AND TEMPERATURE IN IRRADIATED PATIENTS

By JAMES R. GEMMILL, M.D.,
MONESSEN, PENNSYLVANIA

The following is a study of patients having lymphoblastoma who were admitted to

the Massachusetts General Hospital for irradiation. The effect of irradiation upon the temperature is noted and what part the enlarged liver, when present, contributes toward increased temperature. This study

The temperature range showed no relation to the amount of involvement, being high in cases with but one group of nodules and evidencing a moderate increase, or none, when the glands showed marked extension

Massachusetts General Hospital

NAME E R

DISEASE Lymphoblastoma

DATE May 24

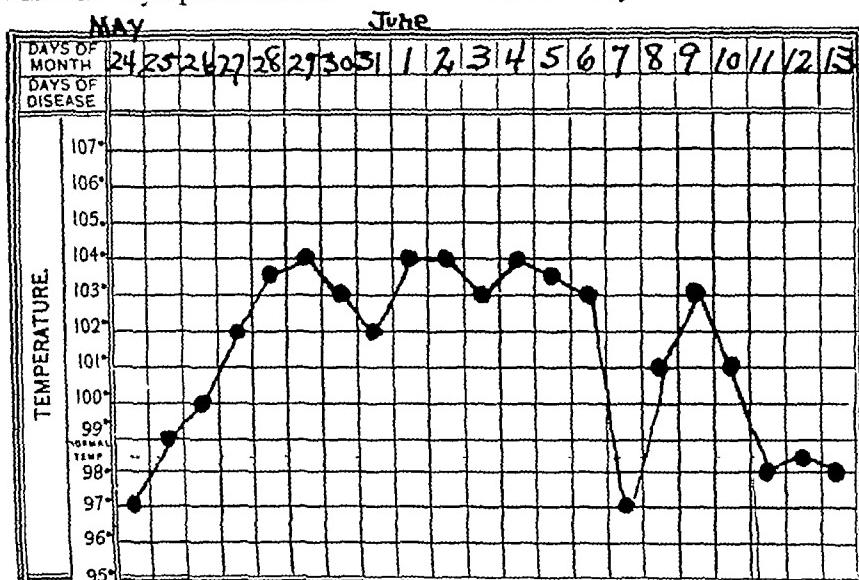


Chart I Temperature range during the time in which the patient was not subjected to irradiation

comprises a group of 73 cases of lymphoblastoma, all of which were proved by biopsy.

Rise in temperature in lymphoblastoma is thought to be due to areas of necrosis which have been observed at autopsy in the glands affected, though many cases having high temperature during the course of the disease and coming to autopsy show no necrosis. The areas involved as shown clinically were the cervical, axillary, and inguinal lymph nodes, the spleen and the liver. In some patients but one group of glands was affected, others showed two or more affected groups at the same time.

of the process. The temperature curve was notably out of proportion to the physical findings. In cases which showed enlargement of the liver the reaction of the temperature was identical with involvement elsewhere. Irradiation with high voltage X-ray was given over the areas involved by the process, the dose being calculated as suitable for the individual and producing improvement in the condition present. Temperature of varying heights was noted at the beginning of the application of irradiation showing no reaction with relation to the time or number of treatments though the patients improved both physically and

**MASSACHUSETTS GENERAL HOSPITAL
(SURGICAL CHART)**

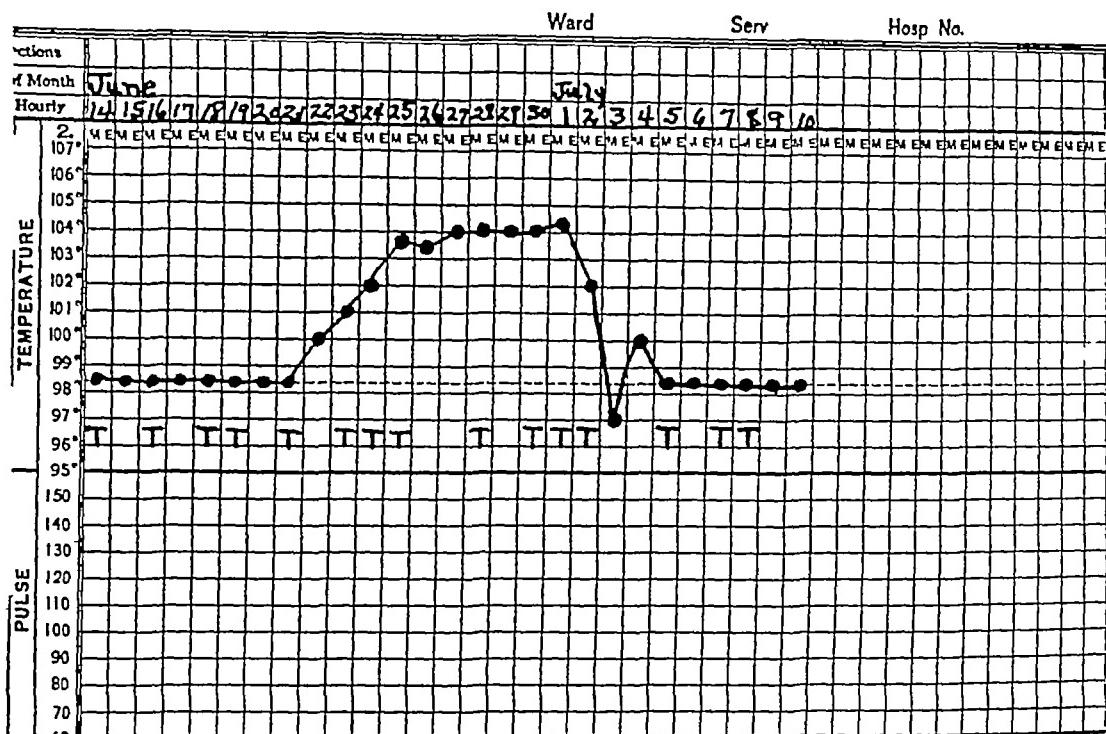


Chart II Temperature range during X-ray treatment "T" indicates days on which the treatment was given

TABLE I
Temperature

| Types | Pel-Ebstein | Prolonged | Slight or None |
|---------------------|-------------|-----------|----------------|
| Lymphoblastoma (21) | 4 | 10 | 7 |
| Pseudoleukemia (25) | 5 | 10 | 10 |
| Lymphoblast (21) | 3 | 8 | 10 |
| Lymphosarcoma (6) | 0 | 0 | 6 |

clinically. A few patients showed a reaction to the effect of the X-rays immediately after treatment, evidenced by nausea and chilling. The temperature remained unchanged.

Baldridge and Awe,¹ in their studies of the incidence of temperature in lymphoma, grouped their cases according to the histo-

logic picture and types of temperature. In a similar manner I have grouped the cases of lymphoblastoma (Table I).

Pel-Ebstein is the name given to a remittent and intermittent type of temperature which rises and remains high for from three to thirty days, and does not show a septic character. The following is a case of this type showing the course of temperature prior to irradiation and the absence of reaction to its effect.

Case 1 A housemaid, single, white, native-born, aged 28 years, entered the hospital complaining of swollen glands on both sides of the neck. Her history included influenza, followed by pneumonia twelve years previous to the present examination, tonsillectomy, and adenoidectomy eight months previous to the present exam-

¹C. W. Baldridge and C. D. Awe. Arch. Int. Med. February 1930. XLV. 161-190

ination, after several attacks of severe sore throat. For a year and a half the patient had noted a feeling of weakness, with gradual loss of weight and alternate swelling and recession of the glands in the neck, the condition being more marked during the seven months preceding examination, accompanied by rise of temperature from 101 to 102 degrees F.

Physical examination showed the cervical glands to be the size of marbles, the spleen palpable, and a palpable mass present near the iliac crest on the right side.

The X-ray examination showed the hilus shadows on both sides to be increased in width and density, with sharply lobulated borders.

The patient was admitted on May 24, 1930. The temperature range from the day of admission until June 11, 1930, during which time she was not subjected to irradiation, is shown on Chart I. On June 14, treatment by irradiation was instituted, the areas treated being the right and left side of the neck, spleen, and anterior and posterior chest. Approximately 525 r units of high voltage X-ray were given over each area in divided doses.

DISCUSSION

All the patients included in this study were admitted to the Massachusetts General Hospital during the period from 1925 to 1931.

Only those cases proved by biopsy to be lymphoblastoma are included in the group.

All the patients received high voltage X-ray treatment while in the hospital and showed improvement to some degree, either symptomatically or clinically.

The temperature curve failed to show any change concomitant with the changes in the involved areas or the application of irradiation.

CONCLUSIONS

1 Irradiation exerts a beneficial influence upon the process of lymphoblastoma although it fails to bring about any change in the various types of pyrexia.

2 The enlargement and recession of the liver and the rise and decline of temperature pursue courses, each without relation to the other, and they are not dependent upon the changes in the general progress of the disease.

ANOMALY OF THE HEPATIC FLEXURE OF THE COLON REPORT OF CASE

By WALTER WASSON, M.D., and JOHN S. BOUSLOG, M.D., DENVER

Anomalies of the hepatic flexure of the colon are not as common as the wealth of literature on the subject would lead one to expect. The one which we wish to present is of a kind recognized by various names, but most descriptively termed (by the Continental authors) "hepato-diaphragmatic interposition of the colon" (1, 2, and 7).

There is a type of redundant colon which shows this same interposition of the colon between the diaphragm and the liver, and which may be permanent or temporary (2, 3). Whether the condition is due to increased length and consequent overlapping or just to malposition, it is undoubtedly anomalous. The etiology is to be found in defective embryological development (2).

The condition was first described roentgenographically in 1899 by Béclère (4), and quoted by Tremolières and Pierron (7) and Just (2), but Curschmann (5) described it fully in 1894 in his classic monograph on the subject. In 1920, Swezey and Black (6) reported a similar case which was detected by one of us in the diagnosis of routine chest roentgenograms. At that time, only one other case could be found. A review of the

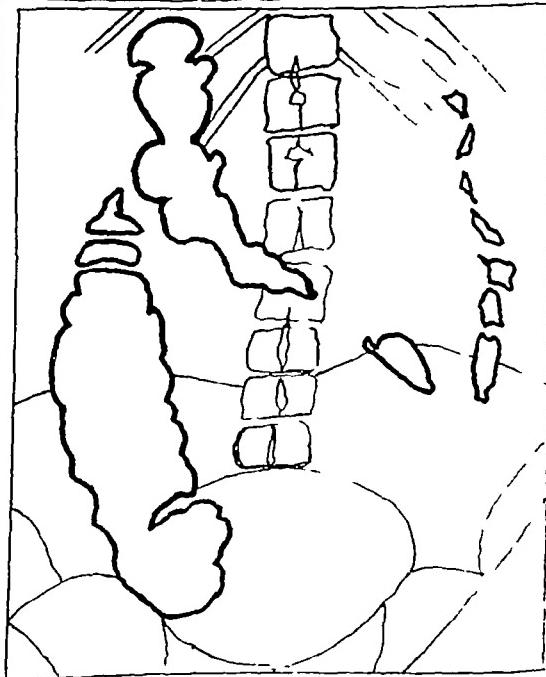
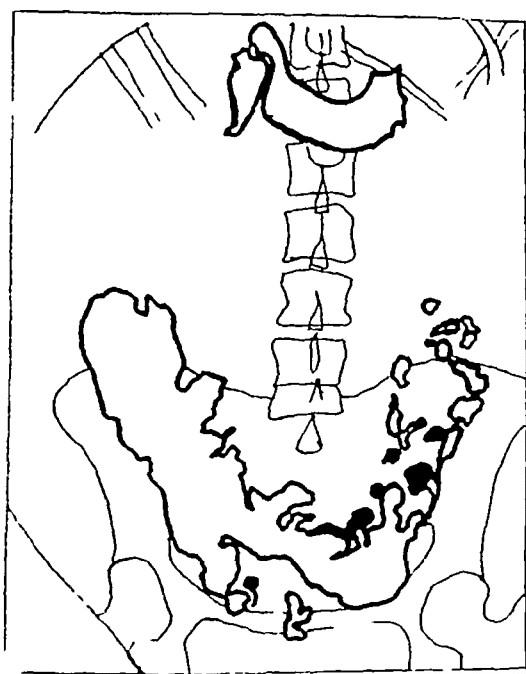


Fig 1-A (upper left) Roentgenogram at 6-hour interval Note unusual position of a well filled duodenal cap

Fig 1-B (upper right) Pen sketch of condition portrayed in Figure 1-A

Fig 2-A (lower left) Roentgenogram at 24-hour interval Note large club-shaped cecum lying low in the pelvis Hepatic curvature not seen and could easily have been overlooked

Fig 2-B (lower right) Pen sketch of condition portrayed in Figure 2-A

literature since that date has revealed only a few more such cases Two were reported by

Tremolieres and Pierron (7), but neither one was diagnosed until operation Just (2) re-

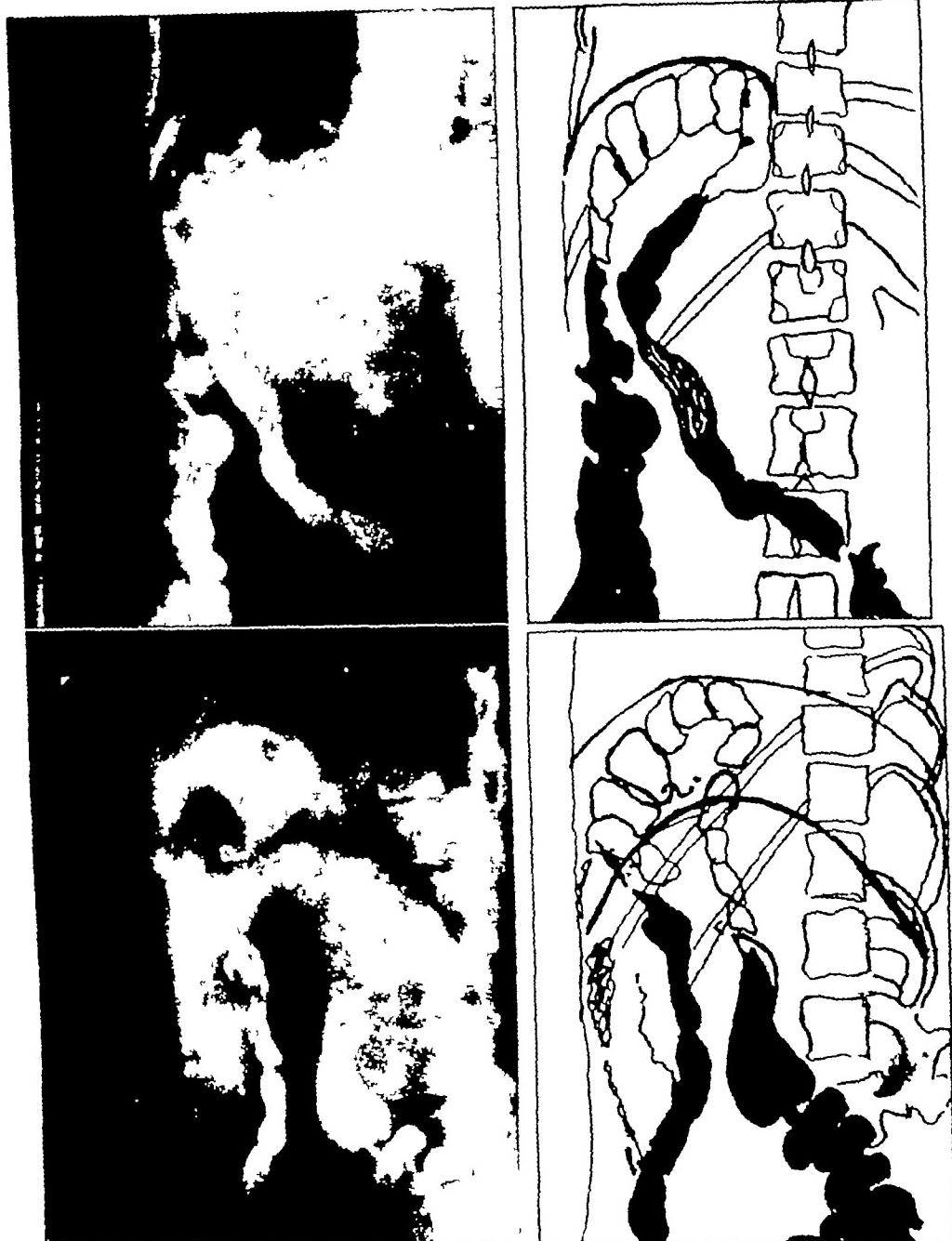


Fig. 3-1 (upper left) Roentgenogram at 24-hour interval, antero-posterior position. Gas-filled hepatic flexure lies directly beneath the right diaphragm.

Fig. 3-B (upper right) Pen sketch corresponding to Figure 3-1.

Fig. 4-4 (lower left) Same as Figure 3-A, except that the view in this instance is lateral, showing that the gas filled hepatic flexure passes over the liver and beneath the right diaphragm.

Fig. 4-B (lower right) Pen sketch corresponding to Figure 4-4.

ports three more cases one permanent and two temporary. There have perhaps been

three cases analogous to ours which have been reported since 1920.

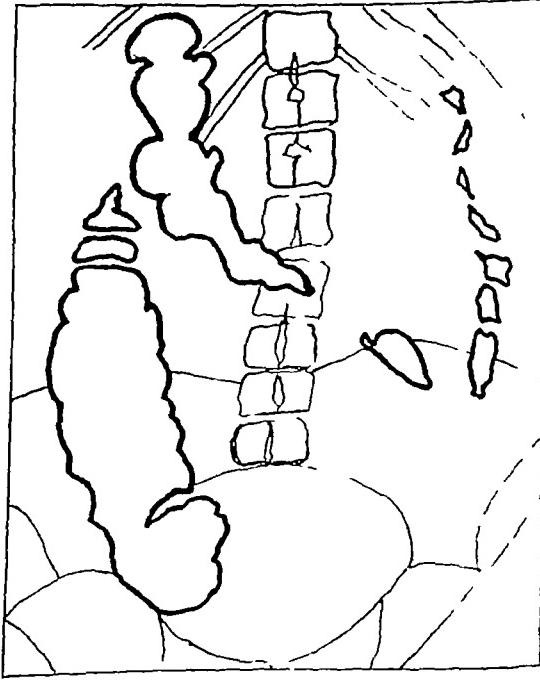
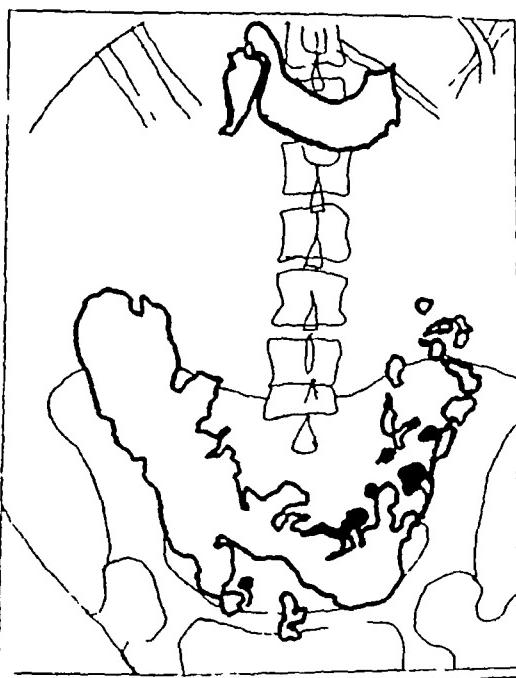


Fig 1-A (*upper left*) Roentgenogram at 6-hour interval. Note unusual position of a well filled duodenal cap.

Fig 1-B (*upper right*) Pen sketch of condition portrayed in Figure 1-A

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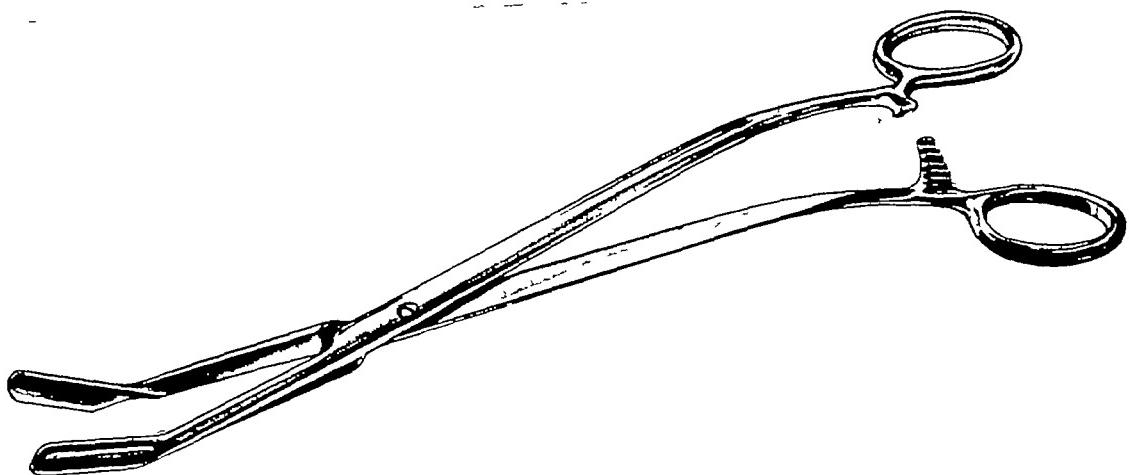


Fig 1 Uterine intubator. The general shape conforms to that of the Bozeman type forceps. The small blades are grooved and form an angle of 30 degrees with the shaft.

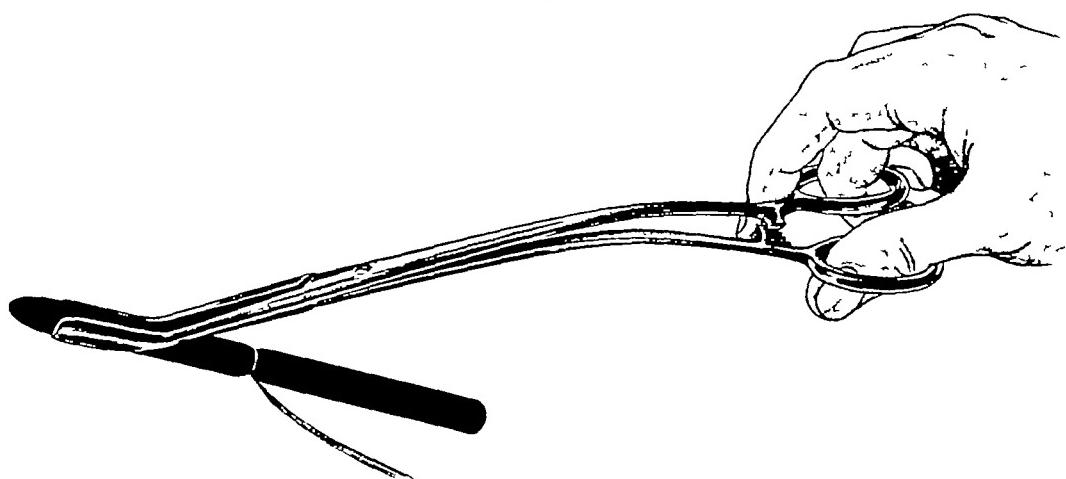


Fig 2 Forceps holding a rubber sound, such as is generally employed in cases of carcinoma of the cervix and uterus, containing several tubes of radium.

logic conditions as malignancy of the cervix and uterus and the benign metrorrhagias, there has not, until now, appeared any specially contrived instrument to facilitate the handling and insertion of these tubes in the uterine canal. Workers with radium have long felt the need of a forceps so constructed that cylindrical tubes, either of metal or rubber, may be readily picked up,

firmly grasped, and easily directed into the cervical or uterine canal. Heretofore, the ordinary curved dressing, straight billed, or placental forceps were employed for this purpose, but none of these held the radium tubes firmly or prevented slipping or rotation, especially when a lubricant had been used on the tube. Moreover, in those cases in which fixation of the cervix is marked,

Most authors agree that the therapy should follow the same lines as that for visceroptosis, and that surgical relief is to be considered only as a last resort

with probable adhesions in the region of the liver, but without any obstruction

COMMENT

CASE REPORT

Mrs E W, white, widow, aged 57 years, was referred to us for gastro-intestinal examination, in February, 1930. She complained of pain in the right upper quadrant, and was annoyed by gas and constipation. The latter responded to laxatives.

Previous History—She had had an appendectomy twenty-five years previous to the present examination. Two years after the appendectomy she passed some kidney stones, had a bladder infection, and was operated upon for a kidney suspension. She also had had an operation for some uterine disorder.

Six or seven years before she was referred to us, she began to have pain in the right side of the abdomen, gas, constipation, pain and indigestion associated with meals.

Present Condition—The patient was a tall, flabby looking woman, whose average weight was 128 pounds. Her general condition seemed fair. She was especially tender over the right abdomen, but no mass was palpable.

Roentgen Examination—Roentgenographically, we found that the gall bladder filled and emptied well. The stomach was poor in tone, and emptied in 6 hours. The pylorus was negative, the duodenum swung to the right, and the first portion turned downward. This was a most unusual position, but there was no definite pathology revealed. The small intestine swung well toward the region of the gall bladder, but there was no obstruction. The cecum was low and large. The hepatic flexure lay beneath the diaphragm, and there was considerable stasis. The roentgen diagnosis was anomaly of the hepatic flexure of the colon,

This case of anomaly of the hepatic flexure of the colon is important in that the anomaly was an interposition of the colon between the liver and the diaphragm. There was considerable stasis of the colon, with toxic symptoms. The inverted position of the duodenum was also unusual. The value of the roentgenographic examination lay in that it demonstrated the fallacy of considering operation to relieve the bowel condition in the right lower quadrant.

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UTERINE INTUBATOR, A NEW TYPE FORCEPS

By HYMAN I TEPPERSON M.D., Attending Radiation Therapist, Brownsville and East New York Hospital, Associate Radiation Therapist, Brooklyn Cancer Institute (Ira I Kaplan, M.D., Director), BROOKLYN, NEW YORK

Although radium tubes have been used extensively in the treatment of such gyneco-

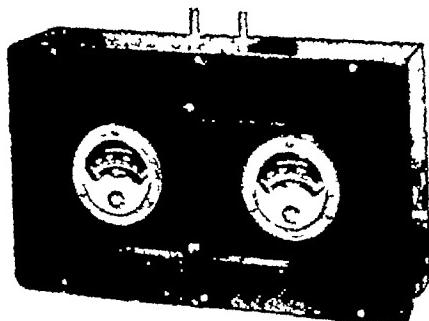


Fig 2 Output divider Note the two milliampermeters and two resistor levers

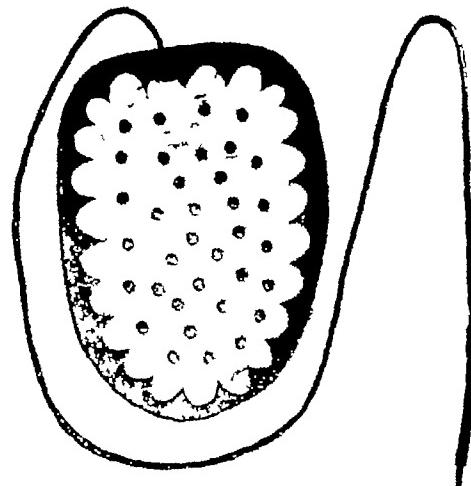


Fig 3 Front electrode accommodates not more than 4,000 milliamperes (16.5 X 11 inches)

tached string. This new type forceps makes the retrieving of the radium tube easy. The forceps grasps the tube readily, prevents its slipping or rotating out of the axis of the canal, and renders easy its withdrawal through the internal os.

SUMMARY

1 A new forceps is described which facilitates the introduction of tubes into the cervical and uterine canals.

2 This forceps can be used for inserting the Kaplan colpostat and cork in the vagina.

3 It may also be used as an extractor for tubes "lost" in the intra-uterine canal.

4 The name "uterine intubator" suggests the purpose of this new forceps.

tion of the super-power diathermy machine. Photographs of all apparatus, including its application to the treatment of one case at a time, have already been published,¹ but for the sake of simplicity and clearness it is thought advisable again to present photographs of the integral parts of the diathermy set-up, including the new output divider, showing two patients under treatment.

It was found that, when one has a number of patients to treat by means of elevation of general body temperature with the new diathermy machine, the cost of the individual treatments and the length of time required to administer a single treatment were prohibitive for many patients. It was due to the ingenuity and electrical knowledge of Mr H D Roop and Mr T T Magnuson, and their personal knowledge of the complicating factors, such as the giving of one treatment at a time, that the output divider was devised. This apparatus has permitted us to treat two patients simultaneously and, therefore, has resulted in a

THE SUPER-POWER DIATHERMY MACHINE WITH AN "OUTPUT DIVIDER"

By J F HAMILTON, M.D., Willis C Campbell Clinic, Memphis, Tenn

Our particular purpose is to call the attention of the profession to this new device, the output divider, in the practical applica-

insertion of a rubber sound containing two or more radium tubes is difficult with the ordinary forceps now generally used, as a slight resistance to the tube causes it to bend and rotate out of the forceps and to leave its position in the canal, often necessitating readjustment of the tube with the unprotected hand.

A new type forceps designated as a uterine intubator has, therefore been devised which avoids the difficulties mentioned. It has the shape of a double curved uterine dilator, with finger eyelets at one end and a pair of small blades at the other end. These blades are one inch long and cylindrical in shape, forming a $\frac{3}{8}$ -inch circular arc and making an angle of 30 degrees with the shaft of the forceps. The inner surfaces are grooved lengthwise. The blades are large enough to handle all types of radium tubes

and thin enough to render additional dilatation of the cervix unnecessary while the radium tube is being inserted. When the tube is grasped by the blades of the forceps, it is automatically adjusted in place by the ordinary finger pressure on the forceps handles. This factor becomes especially helpful when the physician is using large rubber sounds which must be gradually pushed into the canal by several to-and-fro movements.

In using the Kaplan colpostat for the treatment of malignancy of the cervix, the rubber corks are usually inserted by hand. This new type forceps readily grasps these rubber cylindrical applicators and makes their placement in the vagina safe and easy.

The small capsule radium applicator, ordinarily employed in the treatment of metrorrhagias, occasionally gets lost in the uterine canal, due to the breaking of the at-



Fig. 1 Left to right—patient, output divider, super-power diathermy machine, with nurse at control, and patient. This shows the double treatment set-up.

output of the diathermy equipment, each patient, however, being in series with the milliamperemeter and variable resister. The operator can thus not only accurately divide the total output between the two patients but has the means of observing the amount of current each patient receives.

We have found that around 8,000 ma is all that can be obtained from the machine when two patients are treated with only the standard number of electrodes being applied. It is said, however, that the full 10,000 ma could be utilized, if more electrodes were inserted in the circuit. This has not been necessary, as, with only 3,500 ma, we have been able to obtain 104° F. in one and a quarter hour.

The material we are using as electrodes is somewhat different from what was originally used, in that the electrode foil is about 0.2 mm thick, which, in turn, is about one-fifth as thick as that originally used. This thinner material conforms more closely to the contour of the body and is naturally much lighter than the thicker variety. The configurations made into the original electrodes are not incorporated in the thin plates for two reasons: first, we have not found it to be necessary; second, the thinness of the material will not permit so much to be cut away. Our electrodes are made here in the Clinic.

AN X-RAY BOARD FOR OBTAINING ROENTGENOGRAMS OF ANIMALS IN THE HORIZONTAL AND UPRIGHT POSITIONS

By ALTON OCHSNER, M.D., and
I M GAGE, M.D.

Department of Surgery, Tulane University School
of Medicine, New Orleans, Louisiana

The need for a suitable contrivance for obtaining roentgenograms of experimental animals in various positions is apparent. The ordinary clinical roentgenographic table

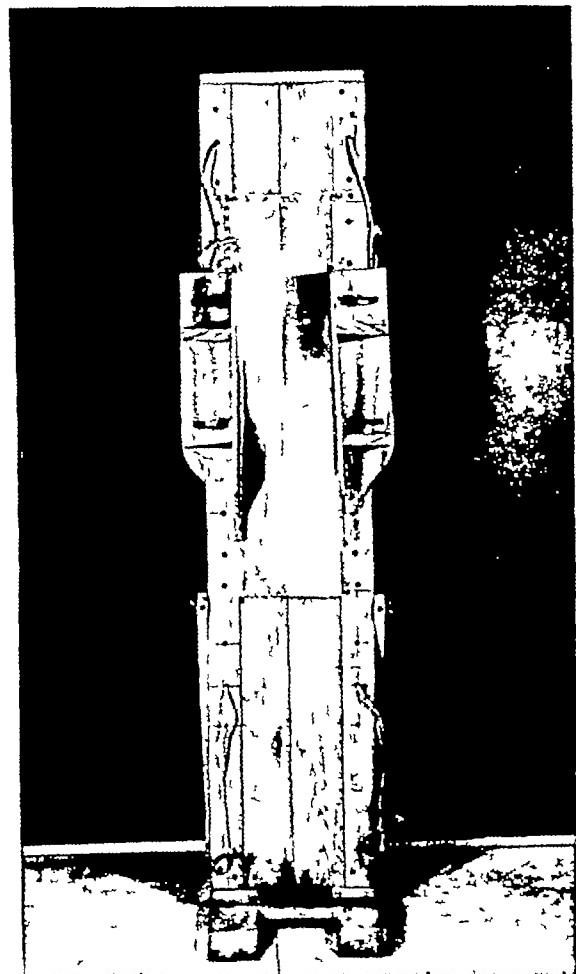


Fig 1. Anterior view of table in the upright position, showing the side boards which are adjustable from side to side and also from end to end.

is practically of no value for use in roentgenography in animals. By means of a board described by Stewart,¹ satisfactory roentgenograms can be obtained in the horizontal position. However, considerable difficulty is encountered in obtaining roentgenograms in positions other than the horizontal.

In the experimental laboratory, as well as in the clinic, the desirability of obtaining roentgenograms, especially in the upright position, is at once apparent, especially in experiments involving the thoracic viscera in which the possibility of the occurrence of

¹H. J. Stewart. A Technic for Measuring X-ray Photographs of the Cardiac Areas of Dogs. *Tour Clin Invest.* 1927, III, 475.



Fig. 4 Back electrode (16 X 10 75 inches)

great saving in time and expense to the patient. We have given about twenty-eight double treatments up to this time, using the new device, and so far it has proved satisfactory with one exception, when the two patients complained simultaneously of getting a shock at the moment the machine was turned on. Of course, the current was immediately cut off. The divider was examined, a short circuit strap installed, and since then not the slightest shock has been experienced.

The output divider consists of a pair of milliamperemeters and a pair of variable resistors, the whole constituting an accessory control which is inserted into the output circuit of the super-power machine.²

The electric circuit of the output divider is so arranged that when it is in use two patients are connected in parallel across the

²H D Roop and T T Magnuson Personal communication.

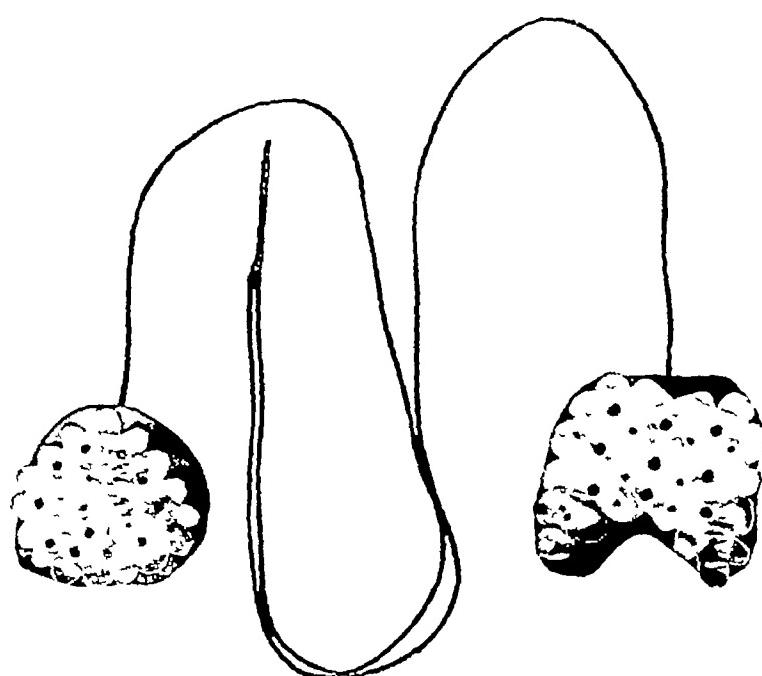


Fig. 5 Double front electrodes which are used when more than 4,000 ma are given. Larger 11 0 X 6 5 inches (center), smaller 9 5 X 8 75 inches (center)

pleural effusion exists Roentgen examinations of the gastro-intestinal tract also are facilitated with the animal in the upright

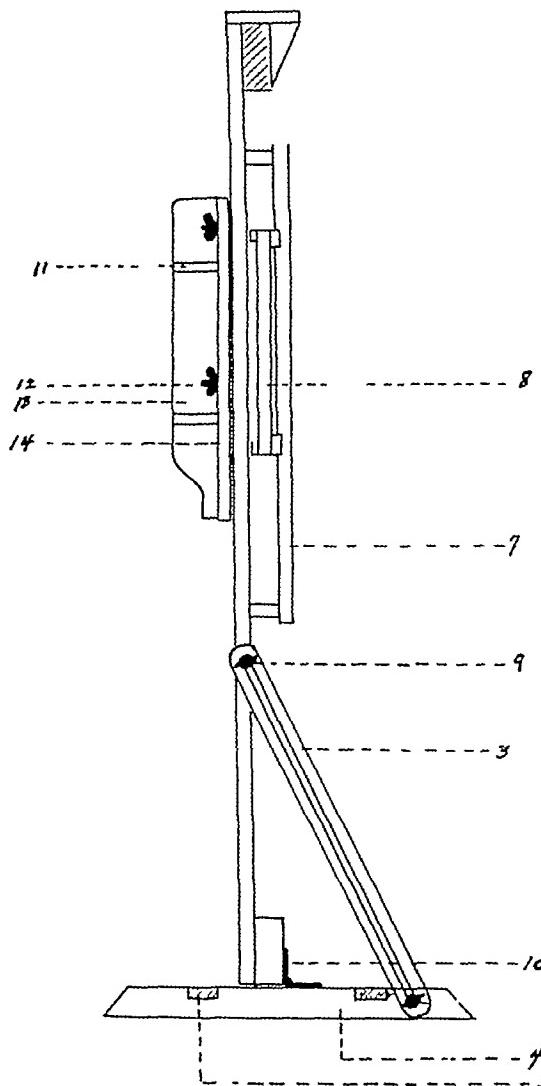


Diagram II Diagram illustrating side view of the board

position, because no pressure is exerted on the intestine by the vertebral column

In order to obtain roentgenograms of the various portions of the body with the animal in different positions, a modification of the Stewart board was constructed (Figs 1, 2, 3 and 4). The board is made in such a way that roentgenograms can be taken in the

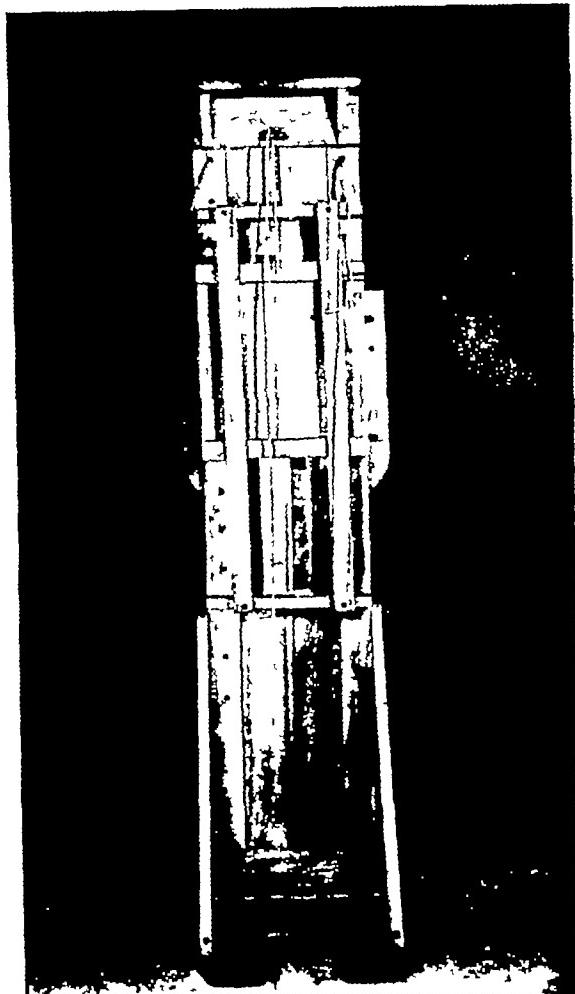


Fig 2 Posterior view of board in the upright position, showing the braces extending from the board down to the base. The plate carrier, which is adjustable, i.e. can be raised or lowered to suit the particular region and animal, is illustrated

horizontal, upright, or intermediary positions between the horizontal or the upright without changing the animal on the board

The board proper is composed of $\frac{3}{4}$ -inch lumber. On either side a piece $2\frac{1}{2}$ inches wide by 5 feet long extends the entire length of the board. At each end a 2×4 , $12\frac{1}{2}$ inches long is used to connect the two side pieces mentioned above. The center $8\frac{1}{2}$ inches of the 2×4 s is beveled in such a way that at the center the greatest depth measures six-eighths of an inch. This is so done that a trough-like depression is pro-

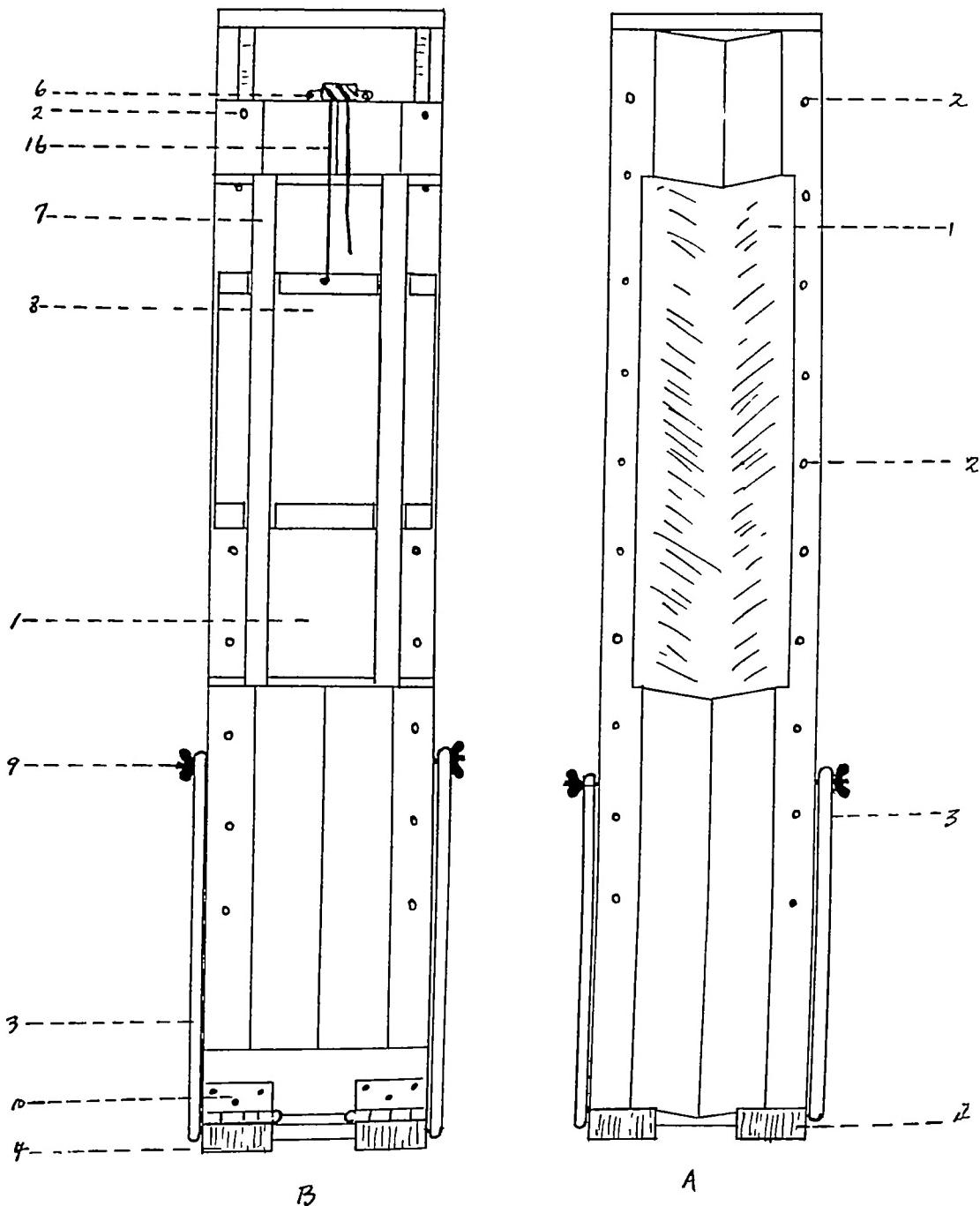


Diagram I. Diagram of front and rear views of board drawn according to scale. Key to Diagrams
 I, II, III 1 Aluminum plate. 2 Hole in board through which thumb screws holding sidepieces are introduced. 3 Brace supporting board. 4 Base. 5 Crosspieces connecting two side pieces of base. 6 "Lock" pulley for rope suspending plate carrier. 7 Track for plate carrier. 8 Plate carrier. 9 Adjustable thumb screw for side braces. 10 Hinge connecting base and board. 11 Support for side board. 12 Adjustable thumb screw supporting side board. 13 Upright portion of side board. 14 Base of side board. 15 Opening in base of side board making side board adjustable. 16 Cross-arm of board, showing curvature in center portion of board.

that the distance between them can be varied. They are fastened by screw nuts which attach the base of the sidepiece to the

fasten the animal in position. Adjustable canvas belts four and six inches in width, which pass completely around the board,

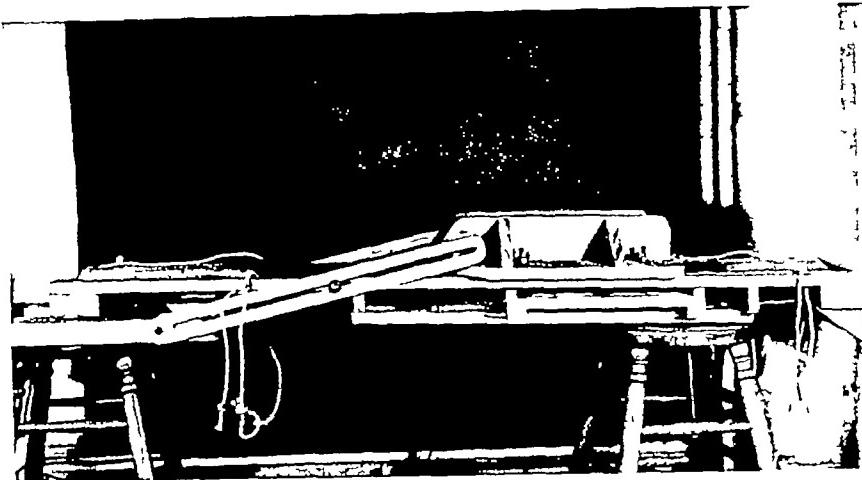


Fig. 4 Horizontal position of board, showing relative position of braces

board proper. The side boards may also be adjusted for different levels. By decreasing or increasing the distance between the two side boards almost any animal can be accommodated and held securely in the antero-posterior position.

An adjustable plate carrier is mounted on the back side of the board, travelling on two tracks 30 inches long, composed of boards seven-eighths inch thick and one and five-eighths inches wide. The plate carrier itself is $12\frac{1}{2}$ inches wide by 14 inches long, designed to carry an 8×10 cassette holder. A five-eighths inch space between the front of the plate carrier and the back part of the board is present so that the cassette may be introduced. The carrier is adjustable and is suspended by a rope extending to the upper part of the board, which passes over a "lock" pulley. The plate may be adjusted without changing the position of or disturbing the animal. Ropes introduced through holes on either side of the upper and lower ends of the board are used to

further serve to fasten the animal securely. The animal is fastened on the board in the horizontal position, following which the board may be placed in any position up to and including the vertical with no effort.

VISUALIZATION OF BILIARY AND PANCREATIC DUCTS BY THE USE OF SODIUM IODIDE

By RALPH L. TROUP, M.D., Department of Roentgenology, Green Bay Clinic, GREEN BAY, WISCONSIN

A male, aged 30, came to the Clinic for an examination on January 1, 1930, with a chief complaint of chills, fever, and jaundice of two years' duration. In 1919, the patient had had a cholecystostomy performed for chills, fever, and jaundice. Following this he felt well until March, 1928, when he developed severe chills followed by fever and became jaundiced for several days. He continued to have these attacks more

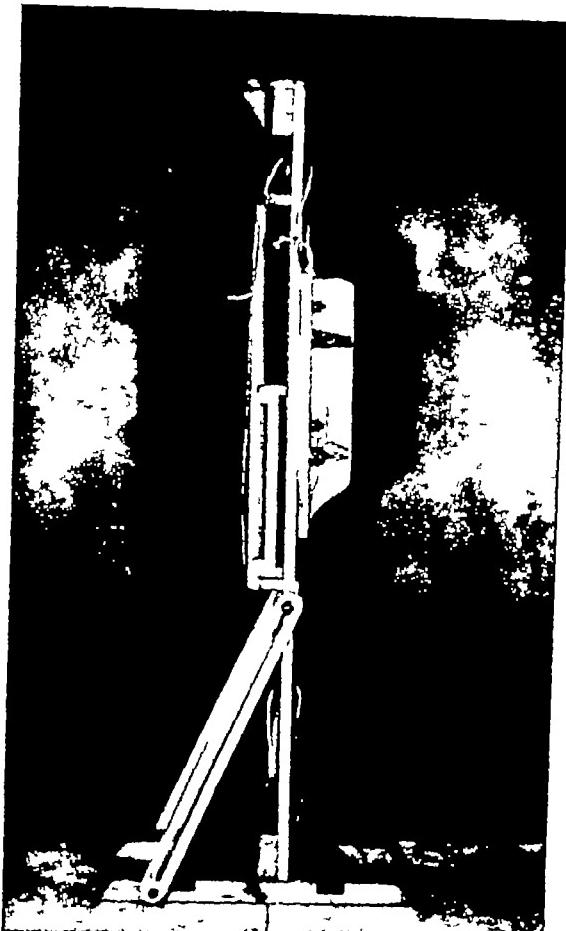


Fig 3 Side view of table, showing position of plate carrier and the relation of the braces to the board and the base.

duced in the center of the board. Two pieces of 1×2 , $12\frac{1}{2}$ inches in length, are similarly beveled. They are placed on the bottom of the board, the one, 8 inches from the upper end and the other, 24 inches from the lower end, so that they serve as supports in the central portion of the board. Two boards, approximately four inches wide and eight inches long, forming a portion of the floor, are placed at the upper end, extending from the upper 2×4 down to the upper 1×2 . Two similar boards, but 24 inches long, are placed between the lower 2×4 and the lower 1×2 , completing the major portion of the trough with the exception of an area 28 inches long in the upper portion

of the board. This area is covered by an aluminum plate, $9\frac{1}{4}$ inches wide by 30 inches long, which is nailed on either side to

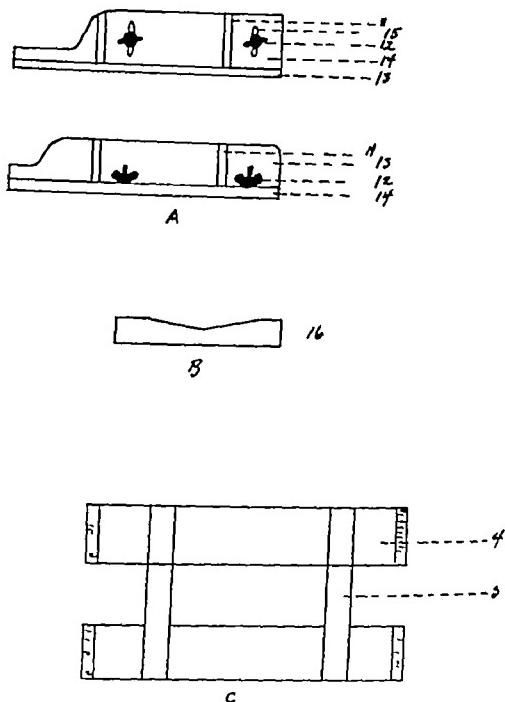


Diagram III Diagram illustrating the component parts of the board, showing construction
A. Side board B. Cross members for the board proper
C. Base

the long members of the board and above and below to the floor of the board. The board is attached to a footpiece composed of two 2×4 's, 24 inches long, and fastened at either end by a 1×2 crosspiece, $12\frac{1}{2}$ inches long. The board is fastened to the footpiece by means of two heavy hinges. Braces on either side extend from the back part of the footpiece up to a point about twenty-one inches above the lower end of the board. These braces, which have a slot extending throughout the entire length, are $24\frac{1}{2}$ inches long by 2 inches wide. On either side of the board proper are right-angled side boards similar to those in the Stewart board. They are 20 inches long and are so arranged

that the distance between them can be varied. They are fastened by screw nuts which attach the base of the sidepiece to the

fasten the animal in position. Adjustable canvas belts four and six inches in width, which pass completely around the board,

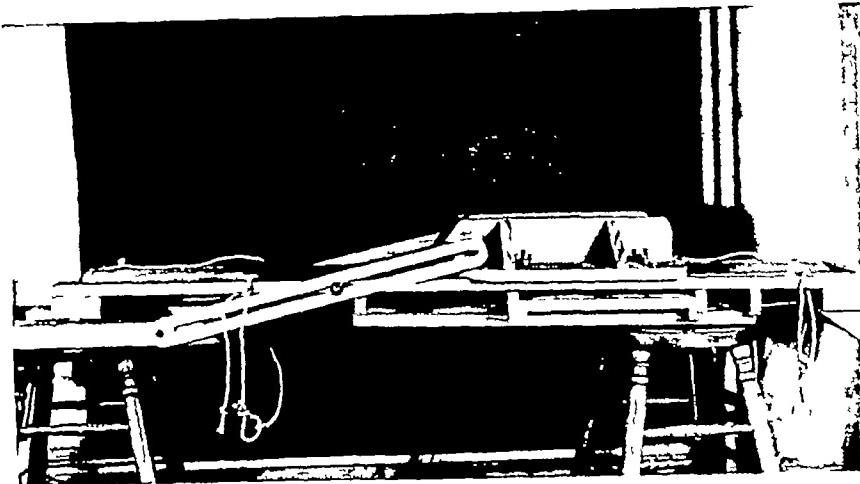


Fig 4. Horizontal position of board, showing relative position of braces

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frequently until September, 1928, when cholecystectomy was performed. Following this, the patient obtained relief for three months when the same trouble reappeared. This time he had severe chills, lasting for

diastolic. His pulse rate was 70 and his temperature normal.

Laboratory Examination.—Blood count hemoglobin 65 per cent, erythrocytes 3,920,000, leukocytes 4,900. Fractional test meal total acidity 20, free hydrochloric acid, 16. Blood Wassermann, negative.

The roentgenologic examination of the stomach was negative.

The diagnosis of common duct stone was made and exploration was advised, but this was not done until March 2, 1931. When he opened the abdominal cavity, the surgeon found very dense adhesions with many small pockets containing vaseline, which had been poured into the wound at the last operation. He was finally able to dissect the liver free from adhesions and to discover the stump of the gall bladder. Because of the patient's poor condition, a mushroom catheter was sutured into the stump of the gall bladder. The patient made an uneventful convalescence and much bile drained through the catheter.

Two weeks following operation, sodium iodide was injected through the catheter until the patient complained of distress. One ounce of 12 per cent solution was used and a roentgenogram was made. The roentgenogram (Fig 1) showed I, Drainage tube, II, pancreatic duct, III, dilated common bile duct, IV, cystic duct, V, stump of gall bladder, VI, junction of common bile duct and pancreatic duct, VII, dye seen in duodenum, VIII, hepatic duct, IX, right and left hepatic ducts and some of the biliary tree in liver.

Figure 2 is an enlargement of Figure 1 to show I, Drainage tube, II, pancreatic duct, III, dilated common bile duct, IV, cystic duct, V, stump of gall bladder, VI, ampulla of Vater—showing negative shadow occupied by stone with narrow band of dye along stone passing into the duodenum, VII, dye in duodenum.

A second attempt to remove the stone was made on June 10, 1931. This was not ac-



Fig 1 See text

from thirty to sixty minutes, with an associated fever. He also became nauseated and vomited, and marked jaundice was present, with some pruritus. During the past two years he has had attacks once a month, lasting for several days, but for the five weeks previous to examination the attacks have occurred once or twice a week being much more severe than the previous ones. Following an attack, he becomes very weak and prostrated. His stools were usually acholic, and the urine very dark.

Physical Examination.—The patient was apparently very sick. The skin and sclera were jaundiced II, the liver palpable in the midline and tender II on pressure. The spleen was palpable on inspiration. He had hemorrhoids II. The feces were acholic. His blood pressure was 110 systolic and 80

complished because the surgeon opened the large bowel in attempting to free the adhesions. The abdomen was closed, the tube

right. The tube was removed in the early part of September and the wound healed promptly.



Fig. 2 See text.

being left in, and the patient made an uneventful convalescence. In July, 1931, a large amount of sour, greenish material came from the tube. This was examined and found to be gastric contents. The patient was given methylene blue, which drained from the tube in a few minutes. Due to the loss of a large amount of gastric contents, the patient felt very weak, so the tube was clamped off and he soon felt all

COMMENT

This case is reported because of complete visualization not only of the biliary tract but also of the pancreatic duct. A fistula was evidently established between the duodenum and the common duct, probably due to ulceration of the stone into the duodenum. The patient experienced no untoward effects from this injection of sodium iodide and to-day feels perfectly well.

EDITORIAL

LEON J. MENVILLE, MD
BUNDI ALLEN, MD

Editor
Associate Editor

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METHODS OF MEASURING RADIANT ENERGY

The present writer for years has stressed the necessity of measuring the intensity of radiant energy as used in physiologic or therapeutic work. In a recent critique, Coulter and Smith¹ have the following to say. "In respect to these experiments and many similar ones, it would be impossible for another group of investigators to duplicate the dosage, as apparently neither the quantity nor the quality of the radiation was sufficiently measured nor is it recorded that variations of the individuals were considered. Thus the use of ultra-violet radiation in secondary anemia is still in the experimental stage." According to Davis,² of the Laboratories of the Desert Sanatorium and Institute of Research, Tucson, "It must be admitted that at present little knowledge is available to the diagnostician to enable him to determine proper dosages of radiant energy. The medical profession has knowledge of some important principles of heliotherapy which clinical experience and biologic experimentation have indicated. But in the case of John Jones, suffering with a particular type and severity of arthritis or with surgical tuberculosis in a certain stage, it is impossible at present to say just what

doses of sunshine or of artificial radiation will exert the most beneficial influence toward recovery. Yet it is evident that such an optimal dosage must exist. We do know that excessively large doses are injurious and that excessively small ones are without discoverable effect. In between such values must lie a value which is best for John Jones in his particular condition. The color and texture of his skin, the sensitivity of his reflex centers, his mental condition, and many other factors may influence his reactions to irradiation. Therefore, the problem of determining the optimal dosage for him is complicated and difficult of solution. Reliable measurements of the intensity and wave length of the radiation used in irradiation experiments are of first importance. Ideally, we should know the radiant power at each wave length employed, at every instant during the time of irradiation. Actually it is very difficult in many cases to measure those quantities continuously while the experiment is in progress."

The methods available for measuring and specifying the total amount of energy emitted by a source, as well as its spectral distribution, may be placed in two groups. There are those employing accurate physical methods, such as thermo-electric measurements (radiometry), chemical reactions (including spectrophotometry), the discharge of electrons, etc. In contrast to these accurate physical methods, the mastery of the technic of which is really, after all, not nearly so difficult as that of many of the clinical laboratory and operative procedures now commonly used, are numerous photo-biologic and photo-chemical procedures, designed for rapid and easy use. These latter methods merely gauge the gross intensity of ultra-violet, either total or of certain wave



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¹J. S. Coulter and E. M. Smith, Jr. *RADIOLOGY*, May, 1931, *VII*, 737-743.
²G. E. Davis. *General Electric Rev.* February 1931, p. 98.



FRANCIS CARTIER WOOD, M.D.
President of the Radiological Society of North America

lengths, but give no information as to the relative intensity of the wave lengths in that region. Many of them are worthy of only passing mention, such as that of Bang³ and of Angus⁴ based on the rate of killing of bacteria and infusoria, respectively, and of Koeppe⁵ based on the extent of hemolysis produced in a suspension of red blood cells in quartz test tubes. Erythema following irradiation has been emphasized as a means of estimating the intensity of ultra-violet radiation, because many believe that the only biologically important wave lengths are those which produce erythema. Luckiesh⁶ advocates the use of the erythema curve, as a parallel method or basis of appraisal to measuring devices, because it encompasses a range of maximum biologic importance, and because the maximum of effectiveness is at a wave length (297 m μ) either coincident with or fairly close to that of the antirachitic maximum. The papers by Hausser,⁷ Hausser and Vahle,⁸ Luckiesh, Holladay, and Taylor,⁹ and Uhlmann¹⁰ give detailed information concerning the relative effects at different wave lengths.

Some time ago Hausser and Schlechter¹¹ pointed out that the effectiveness of radiation in the production of erythema does not merely depend upon wave length, because the quality of erythema is different according to the wave length of the radiation used to produce it. For instance, if the minimal amount of energy which gives rise to a mild erythema of Grade 1 be determined for certain wave lengths, and then multiples of this be used, a similar effect is

not obtained for the different wave lengths. While the degree of erythema produced by an irradiation with 254 m μ slowly increases as the duration is prolonged, the increase is very rapid for wave lengths around 313 m μ , so that doubling or trebling the dose leads to blister formation. The time course of the appearance and disappearance of the erythema is also quite different, that at 253 m μ appearing some time after the maximum effect has been reached at 297 m μ , and disappearing very much more quickly. In other words, taking the "erythema dose" as a biologic measure of radiation may lead to considerable error.

Of the photo-chemical methods, that of Clark¹² stands pre-eminent, and it has been much used in clinical and qualitative laboratory work. Clark proposed that the intensity (in ergs per sq cm per second) necessary to darken lithopone paint to a reflection factor of 50 per cent be taken as a unit of intensity of ultra-violet. There is no perceptible darkening when the paint is irradiated through ordinary window glass with cut off at 320 m μ . The light-sensitivity of lithopone is described by Brickwedde.¹³ In 1929, Clark¹⁴ substituted chemically pure zinc sulphide, moistened with lead acetate, for the lithopone. Recently (1931), she has given¹⁵ some results on the ultra-violet, to which the method is sensitive, in Baltimore sunlight.

The method of Anderson and Robinson¹⁶ is based on the decomposition of oxalic acid in solution with uranyl sulphate, the milligrams of oxalic acid decomposed, determined by titration against a standard permanganate solution, being calculated to ergs. Pohle¹⁷ developed the Berlin and

³S. Bang. Verhandl d. klimatolog. Tagung in Davos 1926, p 222.

⁴T C Angus. Proc Roy Soc B, 1925, XCVIII, 400.

⁵H Koeppe. Arch Kinderheilk 1927, LXXXI, 1.

⁶M Luckiesh. Artificial Sunlight Combining Radiation with Light for Vision. D van Nostrand Co. New York 1930, p 72.

⁷H W Hausser. Strahlentherapie 1928, XXVIII, 25-44.

⁸H W Hausser and W Vahle. Strahlentherapie 1928, XXVII, 41.

⁹M Luckiesh, L L Holladay and A H Taylor. Jour Optic Soc Am August 1930, XX, 423-432.

¹⁰F Uhlmann. Strahlentherapie 1930, XXX, 361-368.

¹¹H W Hausser and E Schlechter. Strahlentherapie 1927, XXVII, 345-352.

¹²J H Clark. Am Jour Physiol, June 1924, LXIX, 200-209.

¹³F G Brickwedde. Jour Optic Soc Am 1927, XIV, 312.

¹⁴J H Clark. Am Jour Hyg, May, 1929, I, 646-662.

¹⁵J H Clark. Jour Optic Soc. Am 1931, XXI, 240.

¹⁶W T Anderson and F W Robinson. Jour Am Chem Soc, 1925, XLVII, 718.

¹⁷E A Pohle. Jour Am Med Assoc 1926, LXXXVI, 818.

Meyer method in which a solution of hydriodic acid in water frees iodine under the influence of intense energy Webster, Hill, and Eidinow¹⁸ take the amount of bleaching, found to be proportionate to the length of exposure, of methylene blue in an acetone-methylene blue mixture in quartz tubes as indicative of the intensity of ultra-violet. In a later paper Hill¹⁹ reported that the standard color tubes made with methylene blue do not keep well, especially in warm weather, and recommended that they be made with copper nitrate and potassium chloride Kimball and Hand²⁰ believe that this method gives only approximate comparisons from day to day, dependent upon many factors, such as the purity of the chemicals and their temperature. Numerous fluorescent "actinometers" have been developed, for example those of Gennant,²¹ Pfund,²² and Anderson and Gordon²³

A number of investigators have made use of the cadmium photo-electric cell notably Dorno,²⁴ as well as Pohle and Sawyer,²⁵ Griffith,²⁶ and Harris²⁷ Burt, at Pasadena, has developed an ultra-violet photometer, the essential feature of which is a quartz bulb photo-electric cell, the inside of which is coated with sodium. The Westinghouse Electric and Manufacturing Company has

also developed a photo-electric cell method with a graphic recording device Kunz and Shelford²⁸ have recently reported on gas-filled photo-electric cells for measuring sunlight under various conditions Some of the cells exhibit a direct proportionality between intensity and current up to a certain limit Stockbarger and Burns²⁹ describe a method in which photo-electric cells and filters can be used to measure intensities of radiation within narrow regions by employing the flicker principle

Any device which has a peculiar sensitivity curve, such as most, if not all, photo-electric cells have, despite its high sensitivity in a particular part of the ultra-violet ($c\eta$, 300-320 m μ), has limited applicability It simply gives information concerning the relative amounts of energy emitted by a source at particular wave lengths The writer has never been able to become even mildly interested in any method which gives merely an approximation of the amount of ultra-violet of certain wave lengths being emitted by a certain source The explanation of such an interest is due to the overpowering effect of the demonstration that certain wave lengths in this region are anti-rachitic This has been injudiciously allowed to warp the judgment of many into believing that these same wave lengths, or nearby ones, are the only ones effective in many conditions

The radiometric method, using a thermopile or thermocouple connected with a high sensitivity galvanometer, with a definite response proportional to the incident energy intensity at all wave lengths, is always the court of last resort, since photographic and photo-electric instruments must be standardized by reference to some non-selective device Radiometry is the elite method for measuring radiant power It involves the measurement of the heat produced when ra-

¹⁸A Webster L Hill and A Eidinow Lancet, April 12 1924 I 745-747

¹⁹L Hill Lancet 1924 II 299

²⁰H H Kimball and I F Hand Bull Nat Research Council No 61, 1927, p 123

²¹A Gennant Jour Optic Soc Am 1926 XII, 65

²²A H Pfund Bull Johns Hopkins Hosp, 1927, XI, 228

²³W T Anderson and E Gordon Jour Optic Soc Am, 1928 XVI, 224

²⁴C Dorno Physik der Sonnen und Himmelsstrahlung 1919

Idem Klimatologie im Dienste der Medizin 1920

Idem Strahlentherapie, 1924, XVIII 177

Idem Strahlentherapie, 1924, XVIII 721

Idem Jahr d Naturforschenden Gesell Graubündens zur Feier des 100 jährigen Bestandes 1925 26 N F 64 215

Idem Handb der Prakt Therapeials Ergeb Exper Forschung 1926 I 367

Idem Verhandl d Klimatolog Tagung in Davos 1926 p 130

Idem Strahlentherapie 1926, XVII 71

²⁵E A Pohle and R A Sawyer Am Jour Roentgenol and Rad Ther, October, 1928, XX, 338-346

²⁶H D Griffith Strahlentherapie 1928 XXIX 592-601

²⁷D T Harris Jour Sci Instr 1929 VI 7

²⁸J Kunz and V E Shelford Rev Sci Instr 1930 I 106

²⁹D C Stockbarger and L Burns Rev Sci Instr 1930 I 76

diation is absorbed, the intensity being expressed quantitatively as the number of calories, or ergs, produced per unit area of absorbing material Radiometers are non-selective, having blackened receiving areas, that is to say, they are equally sensitive to all wave lengths of the radiant energy spectrum In consequence, all energy, regardless of wave length, is absorbed and transformed into heat The responses of non-selective receivers are directly proportional to the intensity of the incident radiation because, for the small rise in temperature involved, the thermal electromotive force is directly proportional to the heat generated, which in turn is directly proportional to the energy absorbed The advantage of the thermal junction over other methods is the ease and accuracy with which it can be calibrated to obtain the measurements in absolute value by resorting to the use of standardized incandescent lamps, operated at a defined voltage or current, and with the intensity of the total radiation at a fixed distance, and in a definite direction, known to a high degree of accuracy Coblenz³⁰ has given particularly good accounts of this method His papers and other pertinent literature are referred to in a publication by Laurens and Mayerson³¹

The use of screens or filters, even when corrections are made for reflection and absorption, to give the percentage values of the ultra-violet, luminous, and infra-red is only an approximate method, although very convenient and extensively used (Gibson³²) Filters to give certain regions of the spectrum may be used when, because of the impossibility of obtaining required intensity, it is not feasible to isolate the desired regions by means of a monochromator The advantages of filters lie in their simplicity

and conservation of energy They do not, however, afford the analysis possible with a spectrometer Jones³³ has recently developed a number of filters made up of selectively absorbing materials

To supplement results obtained with filters, radiation should be dispersed by monochromators or spectrometers, having optical parts transparent to ultra-violet and infrared as well as to luminous energy, and the energy in consecutive narrow bands measured by means of a linear thermopile, placed at the exit slit, connected with a galvanometer With such instruments one may determine the distribution of the radiant energy (per cent of the total) emitted by various sources in narrow bands of the three major spectral divisions (ultra-violet, luminous, and infra-red), the wave length limits of the transmission of filters, as well as the wave length percentage transmission of filter (*i.e.*, the percentage of the incident radiation which gets through after the loss suffered by the transmitted rays due to reflection and scattering)

For simply determining the wave length transmission of substances in the ultra-violet and visible regions of the spectrum, spectrograms are all that are really necessary These give the cut-off in the ultra-violet and qualitatively indicate any absorption at longer wave lengths Spectrograms, of course, also indicate the general nature of emission spectra McNicholas³⁴ and Davis and Sheard³⁵ describe the methods The spectro-photometric method consists essentially in determining at what wave length two contiguous spectra are of equal density, and this value, by this method, is independent of the kind, the law, the chromatic sensitivity, or the length of development of the plate as well as independent of the kind of

³⁰ W Coblenz Radiology February 1928 N 116.
³¹ Item Med Jour and Record 1929 CXXX 691
³² H Laurens and H S Mayerson Radiology April 1929 XII 328 340
³³ E Gibson Jour Optic Soc Am 1926 XIII 267

³⁴ L A Jones Jour Optic Soc Am 1928 XVI, 259
³⁵ Idem Jour Nutrition November 1929, II, 111 123
³⁶ J McNicholas Bur Stand Jour Research 1928 I 930
³⁷ E Davis and C Sheard Jour Optic Soc Am, 1931 XVI 47

developer, the variations in the intensity of the source, and the length of the exposure. The per cent transmission is determined arbitrarily by the ratio of sector openings, the wave length being the dependent variable. For the details of the method the papers by Laurens and Mayerson,³¹ McNicholas,³² and Davis and Sheard³³ may be consulted.

The spectro-radiometric method gives results which are in agreement with photographic determinations made with a sector photometer and quartz spectrograph in the ultra-violet and visible. But, since the photographic method is not readily adapted for measuring the intensity of radiation in the infra-red, only part of which can be photographed by the use of very specially sensitized plates, the radiometric method is the only one to use in determining the intensity of dispersed infra-red. Anderson, Fraser, and Bird³⁴ did an important service in calling attention to the necessity of a consideration of the transmission of ultra-violet by quartz monochromators. They found that the transmission of a monochromator varied between 20 per cent for wave length 248 m μ , and 88 per cent for wave length 404.5 m μ . Forsythe and Barnes³⁵ state that the transmission of a monochromator of theirs is about 25 per cent at 260 m μ , about 40 per cent at 360 m μ , and about 48 per cent at 600 m μ .

There are a number of points which may be cited to show further the necessity of making measurements of this sort. (1) If the energy distribution of a source changes, due to variation in power input, then the transmission of a screen will also change, for example, it is necessary to determine the transmission in terms of the energy input of the source of energy. (2) In the making of screens manufacturers have difficulty in reproducing the same conditions in different melts, so that the cut-off in the ultra-violet,

as well as the transmission as to wave length, varies in different samples of the same kind of screen. In order to obtain exact data it is necessary to determine these factors on samples from each melt. (3) The drop in the transmission curve in the ultra-violet for screens is not a sharp one, but it covers a region of several wave lengths in sweeping from nearly full transmission to absolute cut-off, neither of which points represents the effective cut-off. The zero limit of transmission ascertained from a spectrogram may thus be a misleading measure of the value of a material for purposes of ultra-violet transparency. A screen transmitting to 270 m μ is likely to absorb a large portion of the energy in the neighborhood of 300 m μ . Spectro-radiometric and spectro-photometric determinations of transmission in terms of the energy distribution of the source give this information. (4) Of outstanding interest in connection with the transmission of screens, and in particular of some of the substitutes for quartz, is the fact that the percentage transmission, total and as to wave length, decreases with increasing duration of exposure to sunlight and artificial radiation. Nothing could illustrate more cogently, unless it be a deteriorating mercury lamp, the necessity of constantly making radiometric and photometric measurements to determine the total amount of energy, its spectral distribution, the shortest and longest wave lengths transmitted, and to what extent. (5) When using a screen that has a cut-off let us say between the ultra-violet and the luminous, we must not forget that it probably has a cut-off somewhere in the infra-red. Suppose we have an amber glass, for example, Corning Noviol O, with a cut-off at 370 m μ everything shorter than this being absorbed, with a typical percentage transmission from here up through the luminous. It is seldom realized that the transmission, though it continues into the infra-red region, eventually decreases, so that at about 3,500 m μ the glass transmits

³¹W. T. Anderson, H. D. Fraser and L. F. Bird. Jour. Optic. Soc. Am., 1928, XVII, 454.

³²W. E. Forsythe and B. T. Barnes. Rev. Sci. Instr.

1930 I 569

only 25 per cent of the incident energy (see Laurens and Mayerson³¹) To disregard this infra-red cut-off will give rise to error in the calculation of the distribution of energy between the ultra-violet, luminous, and infra-red portions, particularly if there is much energy in the infra-red spectrum of the source at longer wave lengths than this Solar radiation contains not very much, that of the carbon arc, more As a matter of fact, the infra-red absorption is not much greater for yellow glasses than for white

In order to know just how much energy is being administered it is essential for anyone working on the influence of sunlight to measure solar and sky radiation both spectrographically and radiometrically At our laboratory, spectrograms of the sun are made in order to show the shortest wave length present for the time of day, season, etc., and the total intensity of the radiation is then determined pyrheliometrically Marvin and Kimball³² describe various forms of the pyrheliometer For sunlight we use the one described by Gorczynski³³ This instrument built by Jules Richard of Paris, consists of a large Moll surface thermopile and a registering millivoltmeter It is a handy, sensitive, and accurate instrument It is carried on a clock-driven equatorial mounting which, with a hand-operated altitude and azimuth adjustment, maintains the surface of the thermopile at right angles with the incident rays The calibration of the instrument and of the recording millivoltmeter is described by Laurens and Mayerson³¹ By the use of appropriate screens, not only is the total amount of energy from the sun determined, but its distribution between ultra-violet, luminous, and infra-red as well We also use one of the thermo-electric pyrheliometers of Kimball and Hobbs,³⁴ as made by the Eppley Lab-

oratory This thermopile, attached to a recorder, permits of the determination of the total radiation from the sun and from the dome of the sky The instrument is calibrated so that the record of the thermo-electric current is read as g cal per sq cm per minute By means of screens it is again possible to obtain values for the distribution of the energy

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RADIOLOGY AND PATHOLOGY

In the practice of any medical specialty, there is more or less dependence upon and interrelation with the other specialties The axiom, "No man liveth unto himself alone," may well be stated "No specialist practiseth unto himself alone" In spite of modern specialization, the human body still remains as a unit, and a patient with symptoms referable to one specialty may have the cause of these residing in an organ within the domain of still another Because of the breadth of each and its importance to all specialties, radiology and pathology stand in a unique as well as an important relationship to one another Radiology makes use of the roentgen ray and radium in the study, diagnosis, and treatment of disease Pathology marshals and uses every possible phase of pure and applied science in examining products and portions of the body that may be obtainable for the purpose of aiding in the diagnosis and treatment of disease

Modern diagnosis rests firmly upon the foundation of these sciences No one realizes it more (perhaps unconsciously) than the laity, for whom an X-ray examination or blood test has a well known fascination Every radiologist and pathologist is familiar with the individual who wants an X-ray examination or blood test, who, when questioned, states that he is merely sick and

³¹C F Marvin and H H Kimball Jour Franklin Inst 1926 CCH 273

³²L Gorczynski Jour Optic Soc Am 1924 IX 455

³³H H Kimball and H F Hobbs Jour Optic Soc Am 1923 VII 707

wants to find out what is the matter If either of these sciences were to be suddenly removed from modern medicine, the entire structure would collapse Some of the old-school clinicians decry the progress of modern medicine in these directions, but they do not seem to impede its progress Every clinical practitioner needs the fact finding these sciences offer There is the occasional clinician who insists that he needs neither, perhaps there is that rare individual whose diagnostic acumen has little need for them, but nevertheless there still remain many fine points of differential diagnosis that are radiologic or pathologic in character

Fundamental training in pathology has long been recognized as being both desirable and important for the clinician This is evident in undergraduate and post-graduate schools In the former, pathology is a major subject in sophomore and junior years, and in post-graduate schools from six months to a year is required to precede the clinical training In radiology, however, it is even more important than in the other specialties that there be a thorough training in pathology The proper interpretation of variations in density on an X-ray film is certainly achieved through a knowledge of those changes which produce them Familiarity with the gross and microscopic appearance of tissue, with the resultant process of disease in terms of tissue change, rather than as a clinical symptom, cannot but help to aid the radiologist greatly in his interpretations In addition, the proper interpretation of laboratory findings is always improved by familiarity with procedures and personal knowledge of limitations of technic Then there is the understanding and interpretation of tissue diagnoses and descriptions, so important for subsequent radiotherapy It cannot be expected that the radiologist be a tissue pathologist, but a certain knowledge of tissue pathology improves his ability to direct properly the treatment of cancer and to prognosticate the

effects of such treatment But even with the training suggested, the radiologist remains to a great extent dependent upon the pathologist

Discussion by the radiologist and pathologist of the nature and interpretation of laboratory findings in a given case is often of value in radiologic interpretation, diagnosis, and treatment This is most important in the treatment of neoplasms Proper radiologic therapy of cancer is often dependent on the interpretation of the microscopic findings, and the radiologist's prognosis is partly dependent on the interpretation of the pathology It need hardly be mentioned that knowledge of laboratory findings will often aid the radiologist in his interpretation of the X-ray film There are some radiologists, however, who work objectively, entirely, interpreting the findings as they see them, not desiring any information about the patient This attitude is scientifically commendable, but, practically, there is little question but that an interpretation given with knowledge of the clinical status of the patient is more valuable If a patient has a tubercle bacilluria, how much better that the radiologist should know it when interpreting a pyelogram

Co-ordination of clinical, radiologic, and pathologic findings is often difficult, and consultation and conference between the clinician, radiologist, and pathologist should be encouraged, although in the average hospital it is seldom done It is only by such means that proper co-ordination of results can be obtained Such conferences would lessen the incidence of bilateral pyelography on a patient with a low kidney function, and many other common apparent errors in judgment, but actually lack of proper co-ordination Most important of all is the conference between surgeon, pathologist, and radiologist in relation to cancer diagnosis and treatment The final diagnosis of cancer practically always rests with the microscope, but the problem of biopsy, and

limitation of surgical and radiologic treatment, can best be determined by these three individuals working as a team. The exact location for biopsy, the advisability of treatment immediately following biopsy, and the later treatment are not problems for a single individual but for a team. Any cancer is of sufficient importance to need the combined opinions of an experienced radiologist, pathologist, and surgeon for proper management.

As an example of increased efficiency in routine diagnosis, Bain¹ analyzed 347 cases for diagnosis, all of which had the co-ordinated work of clinician, radiologist, and pathologist. Of these, 51 per cent were diagnosed by clinical means, 35 per cent by radiologic, and 14 per cent by laboratory. These did not include post-operative tissue diagnoses.

From the radiologist, the pathologist has much to learn. This is most evident in bone pathology, in which the correlation of the roentgen film and microscopic study make the complete picture.

Many small communities and hospitals are unable to afford, or do not have material for, full-time specialism, hence there evolve men who combine two or more. Examples of these in relation to those specialists under discussion are surgeon-radiologist, internist-radiologist, surgeon-pathologist, internist-pathologist, and radiologist-pathologist. This latter combination, when possible, is the most desirable to consummate because of the close relationship between the two specialties and because they are both laboratory sciences. Individuals who combine them are quite indispensable.

Combined training in these two specialties, because of their fundamental nature, makes an excellent foundation for special training in other medical specialties and especially for general practice. With such

training there would be more intelligent use of these fundamental sciences.

With such close scientific and practical relationship existing between these sciences, it behooves those practising them as specialties to co-operate most fully, so that they may be better able to interpret their findings.

CLARENCE I OWEN, M D
Pathologist, The Grace Hospital, Detroit

COMMUNICATIONS

THE ANNUAL MEETING

The officers elected at the Seventeenth Annual Meeting, held in St Louis, from Nov 30 to Dec 4, 1931, are as follows:

President-elect, Byron H Jackson, M D, of Moses Taylor Hospital, Scranton, Pennsylvania; *Secretary-Treasurer*, Donald S Childs, M D, of College of Medicine, Syracuse University, Syracuse, New York; *First Vice-president*, W Herbert McGuffin, M D, of Calgary, Alberta, Canada; *Second Vice-president*, Col Henry C Pillsbury, M D, Chief of U S Army X-ray Service, stationed at the Presidio, San Francisco; *Third Vice-president*, John D Camp, M D, Mayo Clinic, Rochester, Minnesota. The *Librarian*, Charles G Sutherland, M B (Tor), Mayo Clinic, Rochester, Minnesota, succeeds himself.

The new *Chairman of the Executive Committee* will be Leon J Menville, M D, of Tulane University, New Orleans. The President and President-elect are, by the terms of the Constitution, members of the Executive Committee. The *two new members* are Frederick H Rodenbaugh, M D, of San Francisco, and Thomas A Burcham, M D, of Des Moines, Iowa.

The Committee on Scientific Awards reported that it had made a survey of the scientific exhibits and had endeavored to judge them both as to their scientific value and the excellence of their presentation. In making

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¹Walter G Bain. Illinois Med Jour., December 1927, 111 479.

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INDIVIDUAL EXHIBITS

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Second Place—Frank B Stephenson, M D, and Kenneth D A Allen, M D, of Denver, Colorado "Bone Tumors"

Honorable Mention—Paul F Cole, M D, of Springfield, Missouri "New Application of the Potter-Bucky Grid to Any Angle, with Special Reference to Head Work"

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sent to the subscribers of *RADIOLOGY*, from 50 per cent of whom replies were received. Of these, 98 per cent responded that they were favorably impressed. At the Editorial Staff meeting, a summary of the replies received was read, and suggestions of value were offered and discussed by a considerable number of those present.

EXCELLENCE OF PROGRAM

There were 165 papers entered on the program, to which five days were devoted. The high degree of excellence of the entire program was a matter of comment by members and eminent visitors as well, the retiring President, Bundy Allen, M D, of Tampa, Florida, and his Program Committee, receiving well-earned praise.

COMMENTS ON MEETING

During one evening session a motion picture depicting the salient features of bone tumors was presented by Charles F Geschickter, M D, of the Garvan Cancer Research Laboratory of the Surgical Pathological Laboratory of the Johns Hopkins University and Hospital, Baltimore.

The same audience that listened to Dr Geschickter also was deeply interested in an address and motion picture presented by Francis Carter Wood, M D, of the Crocker Laboratory of Columbia University, New York City. The film shows with a wealth of detail the work of this great experimental and pathologic laboratory, and no "movie" ever held its audience more enthralled. At the close, Dr Wood explained upon what terms films are available for use before medical societies.

The registration at the meeting was 580, which may be considered a most excellent attendance. An eminent guest was present from Buenos Aires, Argentina in the person of Carlos Heuser, M D, who addressed the Society on the subject of arteriography by intravenous injection.

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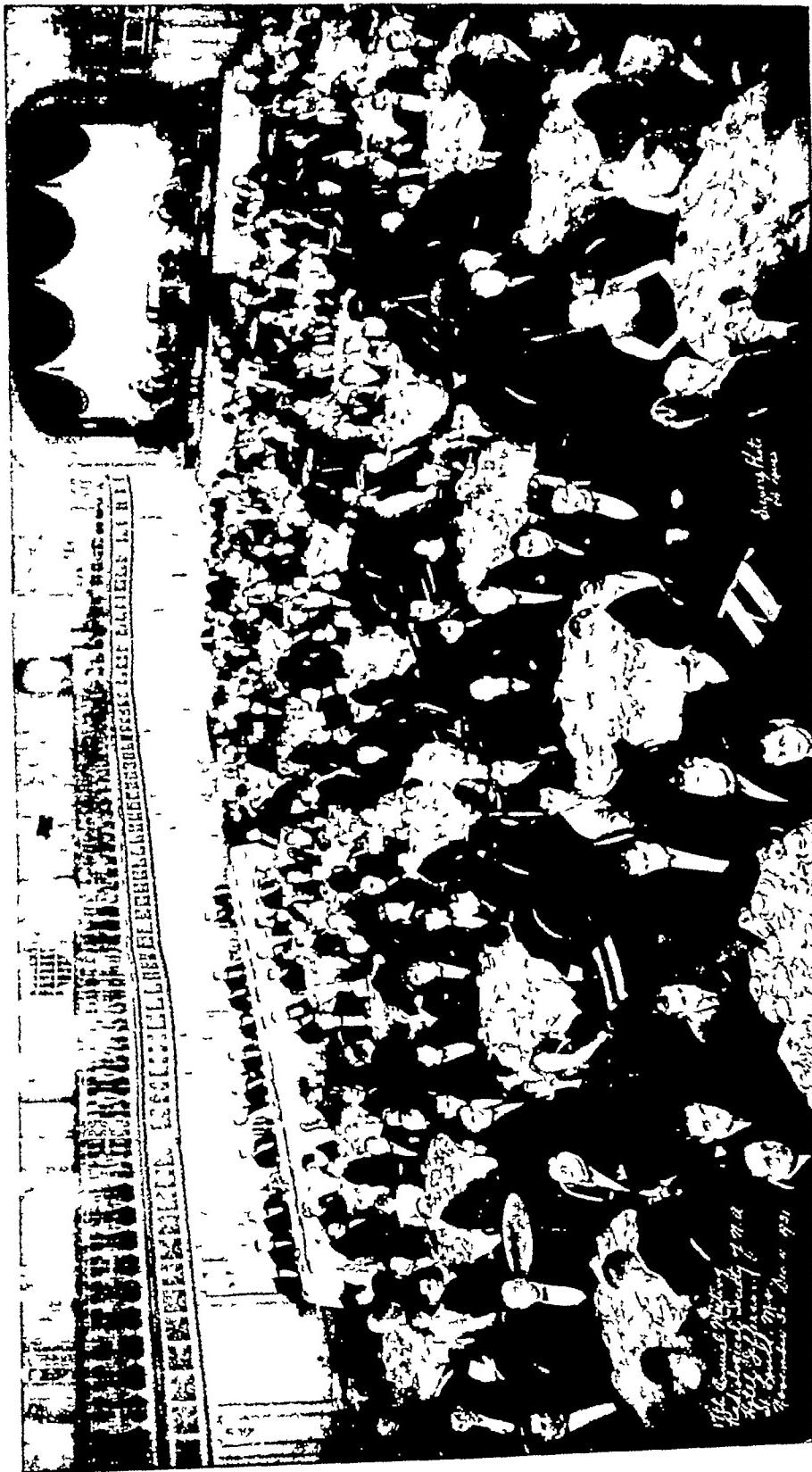
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Banquet Scene, Seventeenth Annual Meeting of the Radiological Society of North America
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banquet were wholly delighted with the musical program provided by the St Louis group, the musicians contributing to it being *artistes* of a high order. The address of the evening was delivered by the Honorable Joseph E. Ransdell, former United States Senator from Louisiana and present Executive Director of the National Institute of Health. He spoke with great earnestness of the Government's latest measures to promote public health, toward which the Chemical Foundation has contributed generously.

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AWARD OF GOLD MEDALS

At the 1931 session of the Radiological Society of North America two awards of the Society's gold medal were made, one to M. J. Hubeny, M.D., of Chicago, and one to Carlos Heuser, M.D., of Buenos Aires, Argentina.

Dr. Hubeny has been a member of the Society since 1918, has served as President, as Editor of *RADIOLOGY* over a period of years represented by the first sixteen volumes of the publication, as President of the American College of Radiology, as Chairman and as Secretary of the Section on Radiology of the American Medical Association, and he has to his credit, besides, years of splendid work for the Society on committees. Yet it is not so much for his constructive work in the Society's behalf that the gold medal was awarded as for his achievements in the advancement of the science of radiology. He is credited with early work on focal infection which resulted

in the publication, in 1921, of an important paper on "Determination of Dental Focal Infection by Means of the Radiograph." Among his other published papers may be enumerated the following, the very titles of which will indicate the broad field of his study and investigation: "Injection of the Sphenoid Sinuses with a Suspension of Barium Sulphate" (1921), "Economics and Socialization of Medicine" (1926), and "The Oblique Projection in Examination of the Lumbar Spine." He is the author, with W. A. N. Dorland, M.D., of the standard text entitled, "Roentgenography in Embryology and Obstetrics," which has also appeared in a German translation.

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The Florida Radiological Society, composed of radiologists practising in the State of Florida, was formally organized on Nov. 14, 1931, at St. Petersburg, Florida, under the temporary Chairmanship of L. W. Cunningham, M.D., of Jacksonville, Florida. A Constitution and By-laws were adopted at this organization meeting, and the following officers were elected to hold office until the spring meeting in 1932:

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Vice-president—Orion O. Feaster, M.D., Power and Light Bldg., St. Petersburg, Florida.

Secretary-treasurer—Frederick K. Her-

pel, M D , Good Samaritan Hospital, West Palm Beach, Florida

Meetings of the Society will be held twice yearly, in November and in May, at the same time as the meeting of the Florida State Medical Association

ROENTGENOLOGICAL CONFERENCE

The New York Roentgen Society invites you to join with the New England Roentgen Society, the Philadelphia Roentgen Ray Society, and the roentgenologists of Baltimore and Washington in a Roentgenological Conference to be held in New York City on Friday, January 29, and Saturday, January 30, 1932 Headquarters- Hotel Pennsylvania

J BENNETT EDWARDS, M D , *Secretary*,
the New York Roentgen Society Address 144 Woodridge Place, Leonia,
N J

DECISION AGAINST THE LANGMUIR TUBE

A decision by the Supreme Court holds invalid the Langmuir patent on high vacuum tubes In refusing to grant a hearing to the General Electric Company, the Court, Justice Stone speaking, declared that the tube patent was invalid for want of invention In detail, it was said that the component parts were well known and had been employed to produce results similar to those produced by the Langmuir tube before the issuance of a patent upon the latter

OWNERSHIP OF ROENTGENOGRAMS¹

The question whether the roentgenograms of a hospital patient belong to the pa-

tient or to the hospital was answered by a court for the first time, so far as is known, in *Hurley Hospital vs Gage*, decided on appeal, April 21, by the Circuit Court for the County of Genesee, Michigan The patient had been roentgenographed in the roentgenographic department of the Hurley Hospital at Flint The usual charge for the service was included in the patient's bill He made a payment on account but refused to pay the charge for roentgenographic service unless the roentgenograms were delivered to him The hospital refused to deliver them and sued the patient for the balance due In the Justice's Court where the suit was instituted, judgment was given against the hospital The hospital, however, because of the principle involved, appealed to the Circuit Court of Genesee County At the hearing on the appeal, no one appeared on behalf of the patient and the case was heard and judgment rendered without the submission of evidence or argument by him

In giving judgment, the court pointed out that the hospital sold and patients paid for, not the material that went into roentgenograms, but knowledge and experience The protection of the hospital might depend largely on the proper preservation of the roentgenograms and, said the court, the films should remain with the hospital Judgment was given against the patient for the balance due on his bill, covering the amount charged by the hospital for the roentgenograms

CORRECTION

On page 898 of the October, 1931, issue of *RADIOLOGY*, in the abstract of the paper on "Roentgen Cataract Its Significance and Prevention," by Max Cremer, the last sentence should read as follows "A thickness of 13 mm of gold corresponds to a lead protection of 2 millimeters."

¹Reprinted by permission from *Journal of the American Medical Association* Vol. 101, No. 21, Nov. 21, 1931, NCVII, 1542.

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in roentgenographic interpretation, and contains a system of exceptionally good reproductions. By means of the detailed analyses accompanying the illustrations, the authors express the hope of aiding the physician in rendering an independent evaluation of his own films. This is undeniably the most logical didactic method, and the expert reader will find few occasions to disagree with the interpretations offered by the authors.

In the introductory paragraphs the value of technically good roentgenographic work is stressed, and the authors point to the superior differential diagnostic value of roentgenographic over purely roentgenoscopic data.

Included is a brief but thorough consideration of the normal chest in which the authors point out certain non-significant findings which are often the basis for misinterpretation by the inexpert. Nearly half of the volume is devoted to the roentgenologic manifestations of the various types and complications of pulmonary tuberculosis. It is the opinion of the authors that this subject is of particular importance to the general practitioner, because it is he who has most frequent opportunity to see this disease in its incipiency. The analysis is thorough, and in every sense practical.

Non-tuberculous lesions are treated under two headings (1) inflammatory, (2) neoplastic. Reproductions exemplifying the different types of pneumonia, pulmonary infarction, lung abscess, bronchiectasis, chronic bronchitis, passive congestion secondary to decompensated mitral disease, and silicosis are exhibited and analyzed in the text. Five examples of primary pulmonary carcinoma, accompanied by a discussion of the roentgenographic data, are given. The picture of pulmonary metastatic carcinoma, of Hodgkin's disease, lymphosarcoma, echinococcus cyst, and aortic aneurysm complete this section. The final section deals with the varieties of inflammatory disease of the pleurae.

The reader who has become familiar with thoracic pathology as manifested roentgenographically will, perhaps, find little that is new or very illuminating in this volume. For such, however, it was not prepared. The authors intended merely to supply the general practitioner with a guide to aid him in his interpretation and to indicate to him the manner in which thoracic disease is manifested on the properly executed X-ray film. It may be, however, that the expert will find perusal of this volume profitable, if only as an example of logical inference and clear exposition—a facility with which is not possessed by all.

AMERICAN MEDICAL ASSOCIATION OF VIENNA

"Hofrat Prof Holzknecht is dead", so ran the sad news rapidly over Vienna. And the whole world was cognizant of that sad story in less than twenty-four hours. The man who paved the way for scientific medical roentgenology has gone. Up until a few hours before his death he faithfully performed his duties and worked upon problems in his chosen specialty.

The members of the American Medical Association of Vienna are to-day grieving the loss of this great roentgenologist, who was truly a martyr. Our official representative to the funeral and memorial services in the Roentgen Institute of the Allgemeines Krankenhaus was Dr G von Poswick, whose interest in and appreciation of the work of Hofrat Prof Holzknecht are well known.

SERIES OF PAPERS BY THE COLE COLLABORATORS

An important series of papers is to be published in RADIOLOGY, which our readers may await with considerable interest. It is

"An Analytical Study of the Roentgenological Exploration of the Mucosa of the Gastro-intestinal Tract" by The Cole Collaborators, Lewis Gregory Cole, M.D., Robert Earl Pound, M.D., Russell Wright Morse, M.D., Courtenay I. Headland, M.D., William Gregory Cole, M.D., and Ames W. Naslund, M.D.

This material was presented in the form of a resume of data at the Third International Congress of Radiology in Paris last Summer. The complete series of papers will include the reports of personal communications from many leading American roentgenologists, an extensive study of the foreign literature, the assembling of material from various institutions, and the designing and actual construction of apparatus for applying the localized pressure technic. The

papers are to be illustrated by the finest type of reproductions of roentgenograms, with full explanatory captions.

The expense of reproducing illustrations of such supremely high quality, printed upon special paper, is, of necessity, great, and in excess of that which the Radiological Society of North America is able to finance. The Chemical Foundation has most generously offered to bear this additional expense, that readers of RADIOLOGY may have the splendid series presented in the most finished manner.

The honor of presenting this subject would, undoubtedly, have fallen to the late Preston M. Hickey, M.D., had he lived, and, considering this fact and the great honor and respect in which Doctor Hickey was held, not only by American roentgenologists but by specialists in this field throughout the world, the articles, when completed, are to be assembled in a bound volume as a memorial to the dean of American roentgenology Preston M. Hickey, M.D.

BOOK REVIEW

ROENTGEN ATLAS OF DISEASES OF THE LUNGS A MANUAL FOR PHYSICIANS (RONTGENATLAS DER LUNGENERKRANKUNGEN) By DR W BREDNOW Privatdozent fur innere Medizin und Rontgenologie an der Universitat Gottingen, and DR E HOFMANN, Gottingen. A paper-bound volume of 167 pages and 85 illustrations and 1 "Diaspositivfilm." Published by Urban and Schwarzenberg, Berlin, 1931. Price, 14 marks.

In a small volume the authors have dealt successfully with the problem of placing in the hands of the practitioner an atlas of roentgenograms exemplifying the more common varieties of pulmonary lesions.

The work was undertaken largely for the benefit of the physician not especially trained

in roentgenographic interpretation, and contains a system of exceptionally good reproductions. By means of the detailed analyses accompanying the illustrations, the authors express the hope of aiding the physician in rendering an independent evaluation of his own films. This is undeniably the most logical didactic method, and the expert reader will find few occasions to disagree with the interpretations offered by the authors.

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J N Ane, MD
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B J DeLaureal, MD
Charles H DeWitt, MD
Cornelius G Dyke, MD
Otto Glasser, Ph D
N G Gonzalez, MD
F L Grandstaff, MD
J E. Habbe, MD
A L Hart, MD

H W Hefke, MD
Joseph Maldonado, MD
L Marinelli
Davis H Pardoll, MD
Ernst A Pohle, MD, Ph D
C G Sutherland, MD
E C Vogt, MD
W W Watkins, MD
W W Whitelock, Ph D

THE APPENDIX (DIAGNOSIS)

Clinical and Radiologic Diagnosis of Chronic Appendicitis Mario Buisson Minerva Med., May 12, 1931, XXII, 714-724

According to the author, the usefulness of radiography in the diagnosis of chronic appendicitis is not yet fully recognized. He answers the criticism of Bobbio and Buchmann by explicitly stating that of all the means available to the physician to-day, radiologic investigation is undoubtedly the best in its differentiating qualities, careful correlation of clinical and radiologic findings is obviously the diagnostic procedure of choice.

He notes that clinical diagnosis of chronic appendicitis relies almost exclusively upon pain detection in definite regions of the abdomen, pain which may or may not be caused by either direct or indirect action of a pathologic appendix. The importance often laid upon these tests is rather unfounded because the appendix is a mobile organ, the position of which is mainly determined by that of the cecum and of the colon, furthermore, its length is known to vary from 1 to 23 centimeters. The patient's history may not be of any substantial aid, because symptoms of chronic appendicitis are anything but clean-cut warnings.

The radiologic technic employed by the author consists in three consecutive daily administrations of from 200 to 250 gr of barium sulphate diluted in from 400 to 500 cc of water sweetened by syrup, in fluoroscopic examination of the patient at the most suitable times, and in the taking of radiographs in various positions.

Normal appendices are distinctly visible, the pathologic appendix is visible in 80 per cent of the cases, but its outlines are not sharply defined and its shadow is not homogeneous. The absence of the appendicular image is a certain indication of appendicitis, this having been always confirmed by surgical control. If the appendix is located, its state may be further ascertained by direct palpation. Fluoroscopic investigation affords a means of detection

of irregularities in the position of the appendix, its state of mobility, and the presence of adhesions. Irritation of the appendicular mucosa is characterized by the short time-interval in which the opaque food is retained in it. Furthermore, the author states that a pathologic appendix also alters the functions of the digestive tract, causing spasms of different natures and locations. He concludes by giving complete reports on eleven cases treated in his own clinic and illustrated by a large number of radiographs.

L MARINELLI

BLOOD CHANGES

The Effect of X-ray Therapy on the Partition of Phosphorus Compounds in the Blood in Disease M Sokolovitch Brit Jour Exptl Pathol., 1931, XII, 147-150

The administration of X-rays influences and causes changes in the partition of the P compounds of the blood. The free P of the blood plasma and that of the red blood corpuscles undergo a change, but it is not uniform. The ester P of the plasma shows a tendency to rise, and the ester P of the corpuscles to fall slightly in amount. The lipin P of the blood plasma shows a tendency to increase markedly and the lipin P of the red blood corpuscles to decrease markedly in percentage.

CHEMICAL ABSTRACTS

The Effect of Roentgen Rays on the Catalase Content of the Blood Geremia Antonio Minerva Med., May 5, 1931, XXII, 685, 686

The author has studied the effect of X-rays on the catalase content of the blood of rabbits and men. As a unit of catalase quantity, the fixation index of the red cells, as obtained by Rigoni's method, was assumed. His results show that in rabbits one SED caused a marked increase in hematic catalase inde-

pendently of the region irradiated Man showed changes of the same nature under hepatic or splenic irradiation, corresponding to one S E D at the surface, a dose of one-half S E D causing no appreciable change

The effects were detected two hours after treatment and remained unchanged or slightly weaker for two days, at which time they started to decrease rapidly and disappeared after ninety-six hours

The author ventures the hypothesis that the increase of catalase content in the blood is a manifestation of the destructive action of the radiation on the cells of the body

L MARINELLI

BONE (DIAGNOSIS)

Certain Radiographic Peculiarities in the Skeleton of an Acromegalic Giant E Forlini. L'Ateneo Parmense, January-February, 1931, III, 5-16

This article treats of the radiographic examination of the cranium and other parts of the skeleton of a female acromegalic giant who died of pulmonary and intestinal tuberculous ulcers, in 1889, at the age of thirty-one

The author's investigations, contrary to previous belief regarding acromegalia and acromegalic gigantism, revealed a lack of the frontal sinuses, and a marked decrease in size of the sphenoidal and molar sinuses. The absence of one of the frontal sinuses, however, has been observed also in normal individuals, according to Nylen, in 5 per cent of 2,000 cases examined

In the epiphyses of the femora, tibia, and humerus, a small area of rarefaction and a diminished compactness of the trabeculae were encountered, whereas there was increase in the thickness of the diaphyses

Regarding the mandibles, it was found that lengthening of the lower jaw-bone may come about in two ways. In the first there may be lengthening without modification of the mental mandible angle, in the other, the angle assumes an amplitude quite disproportionate. While in the first case there are only very

slight modifications of the two mandible branches, in the second case there are changes in the marginal faces and, more characteristic, modifications of the coronoid apophysis, condyle, sigmoid incisure, and their connections. These modifications, the author believes, are seen relatively early in connection with other skeletal manifestations and may furnish an element in the radiologic diagnosis of acromegalia and acromegalic gigantism

W W WHITELOCK, Ph D

Supernumerary Tarsal Bones Valentín C Girardi Prensa Méd Argentina, Aug 20, 1931, XVIII, 360-364

The author gives a good review of this subject and concludes that of such bones the most common are (1) The accessory scaphoid, (2) the accessory cuboid, (3) the os trigonum, and (4) the os vesalianum pedis. The advent of X-ray has brought with it a more complete knowledge of such bones, which is important because of their medico-legal and surgical interest. In adolescence they may present inflammatory processes resembling those present in epiphysis of growing people. They may present total or partial fractures

N G GONZALEZ, M D

Fractures of the Pelvis Everett O Jones and H T Buckner Northwest Med., June, 1931, XXX, 269-273

Authors have described as many as ten different types of fractured pelvis, all of which can be covered by three main classes (1) fractures of the wing of the ilium, (2) fractures of the acetabulum, (3) fractures of the pelvic ring. Fractures of the iliac wing are always the result of lateral compression, the forcing being too high to strike the pelvic ring. Fractures of the acetabulum result from a direct blow on the greater trochanter, when the force is delivered exactly parallel with the long axis of the femoral neck, the acetabulum will yield, a force at any angle to this axis will break the neck of the femur. Fractures anywhere in the pelvic ring result from lateral compression, when forcibly com-

pressed from opposite sides, the breaking points will be somewhere near the intermediate poles. This principle holds, whether there be simply one or more fractures of the rami or the complete double fracture of Malgaigne. In the first place, the lateral compression produces a fracture or fractures about the anterior pole and a distortion or rupture of the sacro-iliac articulation at the opposite pole. This is frequently not disclosed by the roentgenogram and is not discovered until the patient begins to get about. It is a very important factor in the production of disability following this type of injury.

W W WATKINS, M D

BONE (THERAPY)

The Pathology and Treatment of Colles' Fracture M Cole Rous Jour Med Assn South Africa, Sept 26, 1931, V, 593-596

Colles' fracture is caused by a fall on the outstretched hand, in such a manner that the forearm makes an angle of 60 degrees or less with the horizontal. The line of the fracture is oblique and runs from in front backward and upward. The lower fragment is displaced dorsally, proximally, and rotated backward around a horizontal axis. The stability of the wrist is preserved by the ulna alone, the distal end of which is attached to the radius by the triangular cartilaginous disk, and its styloid process is anchored to the medial aspect of the carpus by the collateral ligament. The distal fragment of the radius tends to become displaced proximally, but is held on its medial side by the cartilaginous disk and the ulna, and this serves as an anteroposterior axis passing through the ulnar attachment of the disk, around which the distal fragment swings. As the distal fragment and carpus are carried around this axis, a great strain is thrown on the medial collateral ligament and the styloid process of the ulna to which it is attached. It is this force which frequently fractures the ulnar styloid.

Every case presenting a painful wrist and a history of a fall on the outstretched hand should have a thorough examination. It is im-

portant to observe the relative positions of the styloid, remembering that this process of the radius is normally situated slightly distal to that of the ulna. While the normal radius presents a concavity just proximal to where the pulse is palpated, in this type of fracture this depression is filled by the distal end of the proximal fragment of the fractured radius. The comparison of the uninjured with the injured wrist is considered essential by the author. The X-ray examination is invaluable to show clearly the amount of displacement and to exclude or discover the presence of other injuries to the bones.

The anesthetic which is essential for proper reduction of the fracture may be either local or general. Lorenz Bohler, of Vienna, favors the former—has used it with success in 4,000 cases. In the reduction of this fracture the author favors his method of employing counter traction by means of a canvas strip passed around the lower extremity of the humerus, with the patient's elbow flexed to a right-angle. This allows the operator to use both hands in the reduction. The best and most satisfactory guide in the reduction is the X-ray, and whenever possible the reduction should be done under the fluoroscopic screen. The author believes it is better to see what one is doing in the darkness of an X-ray room than to work blindly by the light of day. A plaster splint molded to the patient's forearm is employed to hold the fragments in place. Roentgenograms should then be made as a final check for the position of the fragments.

J N ANÉ, M D

Operative Treatment of Y-shaped Fractures of the Lower Extremity of the Humerus Terencio Gioia Semana Méd, Nov 6, 1930, XXXVII, 1407-1409

As this fracture is rare and exceedingly difficult to reduce, the author reviews it in detail in this article. He presents the serious factors confronted, such as (1) difficulty in reduction, (2) traumatic arthritis, (3) exuberant periostic proliferation, (4) Volkman's contracture, and (5) nervous complications. He presents a case with a typical Y-shaped

pendently of the region irradiated Man showed changes of the same nature under hepatic or splenic irradiation, corresponding to one S E D at the surface, a dose of one-half S E D causing no appreciable change

The effects were detected two hours after treatment and remained unchanged or slightly weaker for two days, at which time they started to decrease rapidly and disappeared after ninety-six hours

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The author's investigations, contrary to previous belief regarding acromegalia and acromegalic gigantism, revealed a lack of the frontal sinuses, and a marked decrease in size of the sphenoidal and molar sinuses. The absence of one of the frontal sinuses, however, has been observed also in normal individuals, according to Nylen, in 5 per cent of 2,000 cases examined

In the epiphyses of the femora, tibia, and humerus, a small area of rarefaction and a diminished compactness of the trabeculae were encountered, whereas there was increase in the thickness of the diaphyses

Regarding the mandibles, it was found that lengthening of the lower jaw-bone may come about in two ways. In the first there may be lengthening without modification of the mental-mandible angle, in the other, the angle assumes an amplitude quite disproportionate. While in the first case there are only very

slight modifications of the two mandibular branches, in the second case there are changes in the marginal faces and, more characteristic, modifications of the coronoid apophysis, cor-dyle, sigmoid incisure, and their connections. These modifications, the author believes, are seen relatively early in connection with other skeletal manifestations and may furnish an element in the radiologic diagnosis of acromegalia and acromegalic gigantism

W W WHITELOCK, Ph D

Supernumerary Tarsal Bones Valentín C Girardi Prensa Méd Argentina, Aug 20, 1931, XVIII, 360-364

The author gives a good review of this subject and concludes that of such bones the most common are (1) The accessory scaphoid, (2) the accessory cuboid, (3) the os trigonum, and (4) the os vesalianum pedis. The advent of X-ray has brought with it a more complete knowledge of such bones, which is important because of their medico-legal and surgical interest. In adolescence they may present inflammatory processes resembling those present in epiphysis of growing people. They may present total or partial fractures

N G GONZALEZ, M D

Fractures of the Pelvis Everett O Jones and H T Buckner Northwest Med., June, 1931, XXX, 269-273

Authors have described as many as ten different types of fractured pelvis, all of which can be covered by three main classes (1) fractures of the wing of the ilium, (2) fractures of the acetabulum, (3) fractures of the pelvic ring. Fractures of the iliac wing are always the result of lateral compression, the forcing being too high to strike the pelvic ring. Fractures of the acetabulum result from a direct blow on the greater trochanter, when the force is delivered exactly parallel with the long axis of the femoral neck, the acetabulum will yield, a force at any angle to this axis will break the neck of the femur. Fractures anywhere in the pelvic ring result from lateral compression, when forcibly com-

of the lip and of the vulva is not a syphilitic affection. Leukoplakia of the vulva is probably related to cessation of ovarian function.

Chronic inflammatory and obstructive lesions are associated with leukoplakia of the urinary tract.

Quoting from Lane-Claypon, a close association is shown between leukoplakia and cancer. The sex-incidence is similar, both preponderant in males (leukoplakia 95.8 per cent, carcinoma 90.2 per cent). Perrin's figures, quoted by Lane-Claypon, show 64 syphilitic leukoplakia buccalis with 10 carcinomas of the tongue, and 38 non-syphilitic leukoplakia buccalis with 9 carcinomas of the tongue.

The evidence for an association between leukoplakia and carcinoma of the esophagus is extremely slight.

Leukoplakia vulvæ is an accepted precancerous lesion, although here again it is impossible to get reliable figures. Berkeley and Bonney, in reporting their personal experience of 58 cases of carcinoma vulvæ, state that they have not yet seen a case in which leukoplakia did not co-exist. Taussig, in a series of 76 cases of cancer of the vulva, noted leukoplakia in thirty-nine. Carcinoma vulvæ is more frequently multiple in origin than any of the commoner forms of malignant disease.

The relation between leukoplakia and cancer of the cervix is less securely founded, and the total available evidence is scanty and unconvincing.

In the urinary tract also the evidence for an association between leukoplakia and cancer is inadequate.

It is concluded, therefore, that leukoplakia linguae and leukoplakia vulvæ are definitely precancerous lesions, the former usually but not always due to syphilis, with heavy smoking and drinking as auxiliary factors. So far as the esophagus, larynx, cervix uteri, and urinary tract are concerned, an association between leukoplakia and cancer is still unproved.

One of the remarkable features of cancer of the lip is the great difference in its incidence in the two sexes. Of 4,839 cases, 93.5 per cent occurred in males. Another point is the low incidence of cancer of the upper lip,

only 5.8 per cent of a series of 3,763 cases. Nearly one-fourth of all cases in women occur on the upper lip. It is believed that the unglazed clay pipe may cause such chronic burning of the lower lip as to lead to cancer.

The importance of prolonged exposure in the open air is stressed by some who find that laborers, merchant seamen, and outdoor railwaymen have an incidence of 200 or 300 per cent in excess of what might be expected. Open-air workers have unrestricted opportunities for smoking, and it is mentioned that the coal-miners working below ground, where smoking is forbidden, contrast with those working above ground in not suffering from excess of lip cancer.

In certain districts of India and the East betel-nut chewing is a widespread habit, and the incidence of carcinoma of the cheek is extraordinarily high. The betel "quid" is carried in the mouth just opposite the molars, which causes inflammatory thickening and roughening of the mucosa, leukoplakia, and epithelial denudation, followed by progressive ulceration.

Primary carcinoma of the liver is a rare disease in the white-skinned races. In 12,800 autopsies there were only 14 certain cases, or 0.11 per cent. Similar figures have been recorded by other observers. Chinese and Japanese compared to English and American whites have an incidence of 2.21 and 2.18 per cent. Among 91 carcinomas in South African natives, 36 primary cancers of the liver were reported. The hepatic cirrhosis of schistosomiasis has been regarded as a possible factor, and in China, infestation by another fluke has been regarded as a possible factor. Native inhabitants of tropical countries may have repeated and chronic affections of the sources of the portal vein, and this may play a part in the etiology of cirrhosis and cancer of the liver.

There are two main varieties of hepatic carcinoma, the hepatoma and the cholangioma. Liver-cell carcinoma is the commoner.

That cirrhosis of the liver is a precancerous condition is now generally accepted, and the support of this belief comes from figures showing a high incidence of cirrhosis in cases

fracture on which he resorted to surgery, doing a permanent osteosynthesis with wire. His conclusion is that the best treatment in such fractures is the operative one.

N G GONZALEZ, M D

BONE DISEASES (DIAGNOSIS)

Osteomyelitis of Gonococcus Origin in an Infant Report of a Case Philip Palew Am Jour Surg., August, 1931, XIII, 246, 247

The author reports a case of osteomyelitis of gonococcus origin. While a blood stream infection obviously was present, the original portal of entry for the organism could not be determined. X-ray films of the lesion accompany the report.

DAVIS H PARDOLL, M D

A Case of Co-existence of Congenital Luxation of the Ilium and Coxa Varo Gabriele Sacerdote Minerva Med., Apr 21, 1921, XXII, 614, 615

This article is a complete report of the clinical and radiologic findings obtained on a girl four and one-half years old.

Clinical examination revealed protruding trochanters, free movements with the exception of limited abduction of the left thigh. The head of the left femur was palpable under the femoral artery, the right seeming not to be in place. The spino-malleolar distance was 46 cm on the right and 45 cm on the left side, the greater trochanter was 5 cm on the left and 6 cm on the right above Roser-Nelaton's line. Trendelenburg's sign was positive in both sides.

The radiologic examination disclosed iliac luxation at the right and coxa vara at the left. The axis of the femur was at right angles with the axis of the diaphysis. The epiphyseal line was irregular and too vertical to be considered normal, as it formed an angle of 12 degrees with the diaphysis, at its lower third portion it seemed split, both branches surrounding an inverted wedge-shaped nu-

cleus. Surgical intervention was completely successful in correcting both defects.

The author mentions the very few cases described in the literature and insists upon the importance of determining the nature of the defect, because, while rickety anomalies of this kind improve with age, congenital ones tend to get worse and more difficult to correct.

L MARINELLI

CANCER (DIAGNOSIS)

Precancerous Lesions of the Alimentary Tract Lecture I Matthew J Stewart. Lancet, Sept 12, 1931, CCXXI, 565-572

The author in the Croonian Lectures delivered before the Royal College of Physicians of London on June 4, 9, and 11, 1931, states that of 56,896 deaths from cancer registered in England and Wales for the year 1929, 60 per cent in men and 42 per cent in women were referable to the alimentary tract. The most hopeful side of cancer research is that concerned with the demonstration of local causative factors and the recognition and prevention of precancerous lesions. The precancerous lesions of the alimentary tract are by no means so well established, nor are there the same opportunities for prophylaxis afforded as in the superficial forms of malignant disease.

The alleged precancerous lesions of the various portions of the alimentary tract are discussed under the following classifications:

(a) Chronic inflammatory lesions (1) Leukoplakia, (2) lesions due to burns and chemical caustics, (3) cirrhosis of the liver, (4) hemochromatosis, (5) cholelithiasis and cholecystitis, (6) chronic gastric ulcer, (7) chronic gastritis, (8) chronic duodenal ulcer, (9) diverticulitis.

(b) Simple tumors as precursors of cancer

(c) Lesions due to animal parasites

The etiology of leukoplakia is different for different sites. In the mouth, syphilis is the chief cause. Excessive use of alcohol and tobacco were also given as causes. Leukoplakia

cancer of the alimentary tract in man. There is, however, experimental evidence of such in animals. In inhabitants of Egypt there is a high incidence of bladder carcinoma and a closely associated schistosomiasis.

The author stresses the importance of local factors in the etiology of malignant disease, the need of statistical information of racial and geographic incidence of cancer, and study of the environmental factors of the human race.

F. L. GRANDSTAFF, M.D.

The Combined Electrocoagulation-radium Treatment of Skin Carcinoma Anton Musger *Strahlentherapie*, Sept 12, 1931, XLII, 143-147

In 50 cases of skin carcinoma (20 on the nose, 11 on the cheek, 4 in the frontal region, 4 on the lower lip, 3 in the temporal region, 3 in the helix, and 5 on the arm) combined treatment by the endotherm method and radium was carried out. All carcinomatous tissue was first removed and treated by radium immediately, or the next day. Suberythematous doses of from 70 to 80 per cent H.E.D. were applied from 5 to 8 times at intervals of from one to two days. If necessary, this series was repeated from 6 to 8 weeks later. After complete healing of the lesion one or two prophylactic treatments were added.

The end-results of this method were so encouraging that it is recommended as the method of choice. One great advantage of the procedure is the fact that it shortens the treatment period considerably.

ERNST A. POHLE, M.D., Ph.D.

Primary Carcinoma of Bronchus E. E. Atkin *Jour Path and Bacteriol*, May, 1931, XXXIV, 343-448

This study deals with the postmortem findings of 93 cases of primary carcinoma of the bronchus. Of these, 80 were in men and 13 in women.

Microscopically the appearance of the cells varies greatly in different growths and even in the same growth, and there are all stages in

the change from the ordinary columnar to the typical squamous cells. The squamous-cell type exhibits a great tendency to necrosis and cavity formation.

Secondary deposits in the lung not affected by the primary growth are uncommon, but in certain cases in which these did occur the author found it difficult to avoid the conclusion that the spread had been by aspiration via the bronchi. He found that carcinoma does not appear to arise more frequently in one bronchus than in the other.

Metastases to the abdominal organs occur in the following order of frequency: None, 47; liver, 23; pancreas, 18; kidneys, 14; suprarenals, 12; spleen, 4.

E. C. VOGT, M.D.

CANCER (THERAPY)

The Treatment of Carcinoma of the Cervix Uteri A. L. Mudaliar *Antiseptic*, July, 1931, XXVIII, 499-505

In the treatment of carcinoma of the cervix uteri the following methods are now employed: (1) Operation, (2) irradiation with X-ray, radium, or both, (3) irradiation and operation. The question of operability is always subject to a diversity of opinions. While at first radiation therapy offered disappointing results in the treatment of these cases, with improved technic and more clinical experience the results have been more satisfactory.

The author briefly discusses the Heyman, Brussels, Paris, and St. Bart's methods of applying radium to the cervix and vagina. He believes that it is advisable to order vaginal douches before and after the application and in those cases in which the radium is left in place for several days. The removal of the radium should be followed by a cleansing douche daily. Manipulation and curettage are not advised in these cases. In the case of the cauliflower growths the cautery has been found useful in removing exuberant tissue.

The contra-indications to irradiation discussed by the author are as follows: Anemia, with a red cell count below 3,000,000; general

of primary cancer, and comparative infrequency of primary carcinoma in non-cirrhotic livers

The author shows that carcinoma occurring in a cirrhotic liver is the end-stage of a well-recognized series of pathologic changes

Sarcoma of the liver is extremely rare, but there is a certain association of sarcoma of the liver with cirrhosis of the liver

The author, in discussing hemochromatosis, referred to Rolleston and McNee as to etiology, and in the author's series of cases all 13 showed cirrhosis of the liver

The author states that, when recognizable, hemochromatosis is invariably accompanied by some degree of hepatic cirrhosis, and might, therefore, be expected to have an association with primary carcinoma of the liver

After a thorough study of collected series of cases, it is not found possible to attach any significance to the apparently high rate of incidence of primary carcinoma of the liver in hemochromatosis, and the causative factor in both groups is the cirrhosis

The article is accompanied by numerous tabulations of statistical material

F L GRANDSTAFF, M D

Precancerous Lesions of the Alimentary Tract Lecture II Cholelithiasis and Cholecystitis Matthew J Stewart Lancet, Sept 19, 1931, CCXXI, 617-622

Continuing the Croonian Lectures, the author shows close association between cholelithiasis, cholecystitis, and carcinoma of the biliary passages. In 43 cases of the gall bladder, there were 30 with gallstones, or 69.8 per cent, as compared with 16.4 per cent in a control series of 1,031 gallstone cases in 6,284 autopsies. It was found that carcinoma occurred more frequently when the gallstones were multiple and faceted.

Leitch was able to produce carcinoma experimentally by inserting gallstones into guinea pigs' gall bladders.

Gastric ulcer and its relation to carcinoma is discussed at length. After careful consideration of morbid anatomy and histology, site

of the lesion, gastric analyses, and clinical history, it was not possible to state, with any degree of certainty, what proportion of chronic ulcers became malignant. The number is probably small, however, of 109 surgical specimens of carcinoma of the stomach, 17, or 15.6 per cent, showed evidence of having originated in a pre-existing simple ulcer.

In the author's experience, a chronic gastritis of the lesser curvature and pyloric region was common in cases of gastric ulcer, and less common in cases of carcinoma. Gastritis is believed to be a real precancerous lesion, but how often it progresses to malignancy cannot be stated. Chronic duodenal ulcer could not be considered a precancerous lesion, after reviewing the literature and bearing in mind the frequency of chronic ulceration. Carcinoma of the duodenum, in most cases, arises in the peri-ampullary portion, and it is not always possible to determine whether it had its origin in the duodenal mucosa or in the ampulla of Vater.

It was concluded, after reviewing the literature, that diverticulitis has no practical importance as a precancerous lesion.

Carcinoid tumor of the appendix and its association with old inflammatory disease of the appendix is well established. It rarely occurs in the small intestine and when it does so, it is usually multiple.

The lecture is accompanied by numerous statistical tabulations.

F L GRANDSTAFF, M D

Precancerous Lesions of the Alimentary Tract.—Lecture III Benign Tumors as Precursors of Cancer Matthew J Stewart Lancet, Sept. 26, 1931, CCXXI, 669-675

Concluding the Croonian Lectures, the author states that the outstanding example of benign precursor of precancerous lesions in the alimentary tract is the adenomatous polypus of the stomach, colon, and rectum, and the rare condition of "polyposis intestini." There is no evidence that heterotopic tumors are particularly liable to malignant change.

There is scanty evidence of a connection between infestation by animal parasites and

tory function is antagonistic to radiosensitivity. These facts partly explain the differences in behavior of cancers of the same localization and sometimes of the same origin.

Perfectly selective radiotherapy makes use of a favorable interval between the radiosensitivity of the cancerous tissue and those of the normal tissues, both general and special.

There is a very extensive scale of differences of radiosensitivity among malignant neoplasms. The radiosensitivity of a neoplasm can be artificially modified. The intervention of the time factor diminishes or increases the interval between the degrees of radiosensitivity.

When radiotherapy is fractionated and spread out over a very long time, the interval between the degrees of radiosensitivity is diminished, then suppressed and reversed.

When radiotherapy is fractionated and spread out over a moderate time, there is an increase in the interval between the degrees of radiosensitivity between the general tissues and certain special normal tissues which have rapid renewal (for example, seminal epithelium).

Cancerous tissues behave as does seminal epithelium. From this fact follows the abolition of the massive dose for curietherapy and roentgentherapy of epidermoid cancers at the Radium Institute of Paris.

Between perfectly selective radiotherapy and diffusely caustic radiotherapy, there are intermediate stages which may be used in certain determined conditions.

B J DE LAUREAL, M D

Review of the Results Obtained Hitherto by my Cure in Cancerous Patients S
Citelli Minerva Med., June 9, 1931, XXII,
861-865

The author advocates the treatment of tumors by subcutaneous injections of extract of the patient's tumor. Such treatment was started in 1914, and the author recalls the various reports he has since presented. He discusses his results at length and compares them with Fichera's, emphasizing the fact that their methods differ widely in principle, although

histologic examination ultimately reveals very similar action on neoplastic growths.

L MARINELLI

Radium and X-ray Therapy in Carcinoma of the Larynx A Gunsett Le Cancer, 1930, VII, 61-82

This paper is a report on 34 cases, most of which were treated by X-rays, but in the advanced cases radium was applied, either alone or in addition to the X-rays. Hard rays were used, the secondary voltage being 200 K V, and the filtration not less than 1 mm of copper. In the later cases the filter was 2 mm of copper.

The author attaches great importance to the quality of the ray, and states that prior to 1921, when he used a kilovoltage of only 120, with a filter of 5 mm of aluminum, he had never seen a patient with cancer of the larynx survive longer than a year after treatment. Another technical point which is emphasized is the time over which the treatment is extended. A period of about from 15 to 21 days is recommended. Two lateral fields were employed, each 150 sq cm in size, the anti-cathode-skin distance being 40 centimeters. The dose applied to each field was from 2,200 to 2,500 r. The radium was applied on a moulded apparatus at a distance of 4 cm and filtered by 2 mm of platinum. In a few cases needles also were inserted. Of the 34 cases, 10 were intrinsic carcinomas, four of which are reported as cured—one for eight years, one for six years, and two for over three years.

In none of these cases were enlarged glands palpable in the neck. The remaining 24 cases were extrinsic growths, of which four cures of at least three years' duration were obtained. Of these, one remained well for five years and then suffered a recurrence recently. The extrinsic cases were all very advanced and with extensive glandular involvement. It is in these cases that the author recommends radium therapy by external methods, and he gives it as his opinion that only temporary results can be obtained in them by X-ray therapy alone.

WALTER M LEVITT, M R C P, D M R E

emaciation and cachexia, impaired nitrogen metabolism, because radiation tends to increase the blood nitrogen, the presence of inflammatory lesions, complications in the urinary and renal tracts, amenorrhea, and pregnancy. The author believes that Indian patients do not endure large doses of radium as well as Continentals do.

J N ANÉ, M D

Carcinoma Therapy with Extremely Hard Roentgen Rays Erich v Schubert Strahlentherapie, Sept 12, 1931, XLII, 136-142

In this article the author describes the gamma volt apparatus which has been installed in the Women's Clinic of the University of Berlin. The transformer is built for a maximum output of 600 KV, but only 400 KV and 1 ma are practical, as it is not possible to run tubes at higher potentials. As filters, 2 mm of Cu and 2 mm Al are used at 66 cm distance, the output being 32 r per minute. A number of illustrations show the arrangement of the apparatus and tube. The latter is placed in a room below the treatment room. The patient lies in a lead box which affords ample protection. The ceiling and walls of the apparatus room are covered by 15 mm of lead. Fans and electric heaters keep the humidity in the engine room from 30 to 40 per cent. After the application of 3,000 r over a single area within 20 days there appears, about five days after the last exposure, a dark red discoloration and intense pigmentation of the skin, followed by necrosis of the epidermis in large pieces. A healthy looking subepithelial layer covered by epidermis appears within 14 days. During the reaction there is moderate pain in the skin. If 4,000 r were applied within 14 days a similar reaction appeared. In spite of the fact that the treatment was given over the lower part of the abdomen there was no irritation of the bladder or the intestines. The leukocytes dropped considerably, particularly the lymphocytes, and there was a marked effect on the tumor.

In closing, the author believes that this expensive and complicated apparatus should be

used only in advanced cases with involvement of the parametrium which are treated in other countries by the so-called radium bomb.

ERNST A POHLE, M D, Ph D

Radiation Therapy of Carcinoma of the Rectum Ira I Kaplan. Jour Am. Med. Assn., Oct 3, 1931, XCVII, 991-994

Carcinoma of the rectum constitutes one of the most interesting studies for the radiation therapist, because when a patient suffering from this condition is sent for irradiation, it is usually with a gesture of despair, since the results from treatment of every kind have not been too encouraging.

Cancers of the rectum constitute one-third of all the cancers affecting the body. Rectal cancers stand third in the list of cancers of the intestine causing death. To a limited extent and in a chosen group of cases, surgery offers a very good chance for cure. Usually those referred for irradiation are inoperable. Irradiation can be carried on without colostomy.

A newer method, based on the Regaud principle of small doses of radium applied over a long period of time, is described for applying radium to rectal lesions. A special applicator for the method is also described.

C G SUTHERLAND, M B (Tor)

On the Radiophysiology of the Radiotherapy of Cancer Cl Regaud Arch. Radium Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 319-357

Normal tissues and tissues of human cancers have a common radiophysiology.

There are two kinds of action by rays on mixed tissues:

(1) By direct, violent, and relatively short attack on the most sensitive of their cellular varieties (method of cure of malignant tumors),

(2) By progressive modification of the vasculo-connective stroma (palliative treatment of cancers, treatment of chronic inflammations).

Radiosensitivity is dependent on the multiplication of the germinative cells. Secre-

, the experiments undertaken for establishing an accurate physical foundation. The apparatus used, including measuring instruments, is described in detail. The cathode-ray tube furnished by Muller was operated on a vacuum pump and tolerated potentials up to 220 KV at 4 ma, if the window was well air-cooled. Since the article is rather technical, it may suffice to mention some of the conclusions reached by the author.

He developed a graphic method to determine the speed of the cathode rays outside of the tube. In order to characterize the velocity spectrum of a heterogenous cathode ray beam, he introduces the term "effective velocity" and also describes the method for its determination. A comparison of the figures obtained by that method shows good agreement with the figures published by Lenard. An ionization instrument is also described which permits the determination of the practical length of path of the electrons. The law of Schonland, stating that the product of practical length of path and density is constant for several metals, holds also for air. According to the author's measurements the constant for air used in Widdington's equation is too high, while Wilson's equation agrees well with his own figures. He constructed a concentration coil for cathode rays which permits an increase of the surface intensity of cathode rays in the central ray. Experiments were carried out with this arrangement in order to differentiate the effect of the cathode rays proper and the roentgen rays produced at the tube window. It appeared from exposures of tryptophan solutions that the part destroyed by X-rays was 219 times greater than that destroyed by the cathode rays. This shows that the effect of the X-rays produced at the tube window is greater than that of the cathode rays proper. The author also outlines a method which enables one to study the intensity of X-rays produced by cathode rays on various anti-cathodes.

ERNST A POHLE, M D , Ph D

CONTRAST MEDIA

Researches upon the Opaque Medium Most Innocuous in Arteriography Guido

Oselladore Minerva Med , Sept 22, 1930, XXI, 410

The author has compared the effects of a 25 per cent solution of sodium iodide with those of a 40 per cent solution of uroselectan. The tests were performed on animals and under various experimental conditions. Histologic investigation showed that while uroselectan is perfectly harmless in all cases, sodium iodide produces a definitely harmful action on the capillary system and on the adjacent tissues, especially when circulation of the blood is greatly impaired.

The importance of arteriography in cases of gangrene is illustrated by a clinical example in which radiography very neatly determined the limits of arterial occlusion. The radiologic findings were fully confirmed by dissection.

L MARINELLI

The Usefulness of the Different Contrast Media for Intravenous Pyelography A Beutel Med Klinik, Aug 21, 1931, XXVII, 1240, 1241

Three contrast media for intravenous pyelography have been used by the author and he endeavors to evaluate their use. Pyelognost (Roseno), an iodine-urea combination, was tried in eight cases but its use was soon discontinued on account of the lack of contrast and undesirable symptomatic effects. Uroselectan (Binz, Rath, Swick, and von Lichtenberg) was used in 51 intravenous pyelograms. Abrodil (Ossenbeck and Tietze), called "skiodan" in the United States, was also used in 51 cases. Comparison of the results of uroselectan and abrodil showed that both gave satisfactory contrast. Although the price of both drugs is the same, the use of abrodil is less expensive as only one film had to be taken in over half of the cases, whereas, with uroselectan, the pyelograms almost always required two and even three films. The time of preparation and injection is considerably shorter with abrodil. There appeared less reactions from abrodil than from uroselectan. Of the contrast media

The Relative Value of Irradiation and Operation in the Cure of Uterine Cancer
John Osborn Polak Ohio St Med Jour,
May, 1931, XXVII, 363-366

This is one of Dr Polak's last papers, being the Gilliam Memorial Address before the Columbus Academy of Medicine, on Nov 17, 1930

There is still confusion in the mind of the practitioner as to what should be done in the particular case of cervical cancer which he observes. The operable group constitutes only about 10 per cent of the total number of cases seen. By "operable case" is meant one with a growth which is entirely within the confines of the cervix, the uterus being movable, with no detectable parametrial involvement. The other 90 per cent are not operable, can only be treated by irradiation, and do not come into competition with surgery.

"We may state that the superiority of radium over surgery in the treatment of cervical cancer is now generally recognized by surgeon and gynecologist all over the world, with the exception of the three men mentioned in this review (Weibel, Adler, and Bonney), for, if carcinoma of the cervix is diagnosed in its earliest stages, and radium treatment properly administered, it is possible to cure from 50 to 66 per cent of the cases. Surgical treatment of cervical cancer should be virtually abandoned since better results can be obtained by irradiation and X-ray therapy. The woman is better off with no operation than she is with an incomplete one. In early body cancer her best chance lies in radical operation followed by deep X-ray irradiation."

W W WATKINS, M D

The Treatment of Metastatic Involvement of the Neck Secondary to Intra-oral Cancer
Orville N Meland Am Jour Roentgenol and Rad Ther, July, 1931, XXVI, 20-22

It is emphasized that all enlarged cervical nodes found co-existing with intra-oral cancer are not necessarily malignant, hence, needling or other form of biopsy is at times necessary to establish the fact of gland extension. In intra-oral malignancies, the author

divides his cases for gland treatment into three groups

Group 1 consists of cases given prophylactic radiation in which no regional metastases can be demonstrated. These patients are given high voltage X-radiation pushed to the point of saturation on the side where metastasis might be expected, with half the dose on the opposite side. If radium is used, it is in the form of a pack, filtered through one millimeter of brass at three centimeters' distance for a total of 6,000 milligram-hours. Group 2 is the surgical group, showing one or more movable, intact, unilateral nodes which are surgically removable. These are first given a thorough course of X-radiation over a period of from three to four weeks, then if no regression takes place, they are given either a radium pack, or electro-surgery is used. If electro-surgical removal of the nodes is done, the edges of the wound are planted with radium needles. Occasionally with only a single node involved, blind needling is done, but this is considered a relatively inaccurate method as compared with electro-surgical exposure. Group 3 is the palliative group which is treated mildly by irradiation to retard progress of the disease, relieve pain, and prevent rapid breaking down of primary or metastatic masses.

J E HABBE, MD

CATHODE RAYS

Investigations Concerning the Biologic Effects of Cathode Rays I—Introduction
B Rajewsky Strahlentherapie, Sept 12, 1931, XLII, 1-5

II—The Physical Properties of the Radiation Emitted by a Lenard-Coolidge Tube
W Gentner Strahlentherapie, Sept 12, 1931, XLII, 6-55

Rajewsky states that the data published so far concerning the biologic effect of cathode rays are not comparable. This is due to the fact that no qualitative and quantitative measurements were carried out. A systematic study of the problem, therefore, seems indicated.

Gentner presents the first part of the study,

the sympathetic. At first there is a fall of basal metabolism and then an increase. During the fall, the organism does not react to a fresh diathermic application. The application should only be renewed when the effects of a previous one have passed off. The variations of basal metabolism are not parallel to the modifications of other symptoms or to variations of the subjective state of the invalid.

CHEMICAL ABSTRACTS

Diathermy in Acute Inflammatory Conditions B N C Roy Antiseptic, July, 1931, XXVIII, 540-544

The high voltage used in diathermy results in the current passing along a direct path between electrodes. Those tissues which are situated between the electrodes are heated so rapidly that it is impossible for the circulatory system to equalize the temperature immediately. An acute temporary dilatation of capillaries occurs which results in acceleration of the circulation of the blood in the deeper tissues. This facilitates the cellular interchange of gases and fluids and an increase in local resistance. The temporary dilatation is followed by contraction, which restores the tone to lymphatics and capillaries. Diathermy raises the body temperature to some extent and lowers both systolic and diastolic blood pressures.

We depend upon the leukocytes and the immune bodies for a healing process. Anything which helps in attracting and concentrating these agencies in the affected tissues will, therefore, aid in the healing. Consequently, what is required is some special means to make the area more approachable and permeable by the formation of new capillaries, allowing more passage of blood. Diathermy properly applied is believed by the author to accomplish this admirably.

J N ANE, M D

DOSAGE

The Diversity of Reactions of Tissues Treated by X-rays, Including the Time Fac-

tors and the Relations of the Dosimetric Biology in the Radiotherapy of Malignant Tumors Cl Regaud and R Ferroux Arch Radium Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 293-318

Following considerable experimental work, the authors come to the following conclusions:

(1) The sterilization of seminal epithelium by X-rays, be it partial or total, is irreparable.

(2) It is impossible to sterilize the testis of the rabbit by a single irradiation, without the production of radiolesions of the skin, often fatal and always the cause of cachexia.

(3) The massive dose which causes severe radiolesions of the skin is between 4,000 and 4,400 Solomon R units.

(4) If the X-radiation is produced under high tension (180 K V), the changes of filtration between 0 and 8 mm of aluminum modify very little the relation between the ionometrical dose and the greatest biologic phenomena.

(5) When the distribution of the rays is spread out over a longer time, the threshold dose for radio-necrosis increases proportionately.

(6) On the contrary, the radiolesions of the seminal epithelium are not diminished by the lengthening—up to a certain limit—of the time of treatment, the doses remaining equal.

(7) This discordant behavior of the tissues allows the destruction of all the spermatogonia, with the production of serious lesions of the skin.

(8) For a dose of about 5,000 R the optimum arrangement of the time factor appears to be obtained by the equidistant distribution of four or five equal fractions in from four to nine days.

(9) Radiotherapy gains greater selectivity when the dose is fractionated and spread out.

(10) Is the dose necessary for sterilization increased, maintained, or diminished by being fractionated and spread out? This question remains unanswered.

(11) The analogy between the behavior of the germinative spermatogonia and certain cancerous tissues has led the Radium Institute of Paris to prefer, for the treatment of

available so far, abrodil (skiodan) appears to be more satisfactory in fulfilling the requirements

H W HEFKE, M D

CYSTS

Congenital Cysts of the Lung A Dethmers Acta Radiologica, 1931, XII, No 66, 15, IV, 135-139

The author presents the case of a woman 34 years old who entered the hospital with a diagnosis of pulmonary tuberculosis. Her general health had always been good, in spite of a cough since the age of five years. She had worked without physical difficulty as a servant and in a factory. Because two sisters had developed pulmonary tuberculosis, she had had her chest examined in 1918. At that time the physician advised a rest cure at home. Unfortunately there was no roentgen examination on this occasion.

In 1920, she went through a normal pregnancy and delivery. In 1923, she had a laparotomy, with removal of one tube and anterior fixation of the uterus. In 1924, under spinal anesthesia, an ovarian cyst was removed. After these operations the patient regained her good general health. Up until the last year before her admission to the hospital she had not had any expectoration, but during this latter twelve months she began to raise sputum and had several febrile attacks resembling influenza. Dyspnea also had recently developed.

At the time of admission to the hospital her condition was as follows. No loss of weight or strength, appetite good, pulse and blood pressure normal, no fever, von Pirquet negative, Mantoux positive, Wassermann negative, complement fixation for echinococcus negative, about 60 c.c. of sputum daily, negative for tubercle bacilli. Chest examination showed tympanitic percussion note over the right upper lobe, bronchial breathing, large and moderately coarse râles over the same area.

Films of the chest showed that the whole upper right lobe was filled with irregular,

sharply outlined annular shadows, one of which presented a fluid level. The remainder of the chest appeared normal. Lipiodol was administered under fluoroscopic control. Films made at this time showed lipiodol in numerous cavities throughout the right upper lobe. Very fine reproductions of these two sets of chest films illustrate the article.

The author feels that there was no foundation at all for the diagnosis of pulmonary tuberculosis and that the history and negative laboratory findings rule out echinococcus cysts and bronchiectasis localized in the right upper lobe. He regards the case as one of congenital cysts of the lung and reviews briefly the cases reported in the literature, most of which have been diagnosed only at autopsy.

A L HART, M.D.

Suprahyoid Dermal Cyst Implanted in the External Auditory Meatus Atilio F Parodi Prensa Méd Argentina, Aug 20, 1931, XVIII, 359, 360

This case is here presented because of the unusual site of the cyst. Only one other case has been reported in the literature. The patient is a girl 14 years old, who, a few months after birth, presented a lump in the left submaxillary region. This remained about the same size until the first menstrual period, when it started growing rapidly. The cyst was injected with lipiodol and radiograms were taken. Finally, it was dissected *in toto*.

N G GONZALEZ, M D

DIATHERMY

Influence of Diathermy of the Thyroid Gland on Basal Metabolism J Jankowski and L Ptaszek Compt rend soc de biol, 1930, CIII, 425-427, Physiol Abstracts, XV, 315

Diathermic treatment of the thyroid gland caused an increase of basal metabolism which was parallel to the improvement of symptoms. The reaction of the organism to this stimulus has the character of an endocrino-vegetative reflex. In the first phase there is excitation of

pencil These varices are covered by only a thin layer of connective tissue Their danger lies in their tendency to bleed The upper esophagus may be affected similarly in obstruction of the superior vena cava

There are three important causes of portal obstruction with varicosities in the esophagus (1) Cirrhosis of the liver, (2) syphilis of the liver, (3) portal thrombosis The clinical diagnosis of esophageal varices is extremely difficult The patients have usually been thought to have peptic ulcer Only a few cases diagnosed at roentgen examination have thus far been reported, but, no doubt, as the technic improves more cases will be found antemortem

The author reports the two following cases

A woman of 48 years had vomited blood on several occasions The clinical diagnosis was peptic ulcer Ordinary roentgen examination of the stomach showed medial displacement of the fundus and pars media by an enlarged spleen but no other pathologic changes in stomach or duodenum The esophagus was then examined with both thin and thick opaque material Films made while the barium mixture was passing through the lower esophagus showed semicircular filling defects irregularly scattered through the esophagus, while films made after the barium had passed into the stomach showed remnants of the opaque material lodged in the grooves and about the edges of the filling defects At autopsy large varicosities were found in the lower esophagus and the fundus of the stomach, and, in addition, cirrhosis of the liver, subacute hepatitis, and cholelithiasis

A man of 47 years had ascites Examination of the esophagus showed the same appearance as in the first case Autopsy was not obtained in this patient

A L HART, MD

THE ESOPHAGUS (THERAPY)

Surgical Treatment of Idiopathic Dilatation of the Esophagus Henri Oberthur Arch d mal de l'app digestif, June, 1931, XXI, 649-679

A simplified surgical procedure is offered for the relief of idiopathic lower esophageal

dilatation Two cases are presented, both permanently relieved by this benign and efficacious method which is a modification of Heller's and Wendel's methods It consists of an extra-mucus esophagoplasty through the upper abdominal route The left triangular ligament is cut, allowing more freedom to the liver and better exposure of the cardia The peritoneum is then cut at its reflection on the diaphragm and the esophagus The small omentum is split along the right side of the esophagus, exposing it and the diaphragmatic opening Posteriorly it is freed from the meso-esophagus with the fingers With curved closed scissors and tampons it is further freed from the diaphragmatic pillars and pulled down from eight to ten centimeters The muscularis is incised anteriorly and vertically beyond the entire length of the contracted area

Radiologically the results are perfect, the dilatation diminished considerably, and the passage of food unobstructed The etiology is discussed and the author believes the mechanism to be a primary dilatation rather than a congenital defect This is followed by local irritation and stasis, the contributing factors being insufficient mastication, poor dentition, alcoholism, spices, badly prepared and heavy foods This eventually leads to a cardiospasm and inflammatory stenosis Medical treatment has never cured a cardiospasm, and dilatation methods are frowned upon as being dangerous and giving but fair results

B J DE LAUREAL, MD

EXPERIMENTAL STUDIES

The Biologic Study of Radiosensitivity Part I—The Effect of X-rays upon the Immature Tissues of Plants J Nakagawa Japanese Jour Obstet and Gynecol, June, 1931, XIV, 218-224

Experiments have proved that small doses of X-rays stimulate germination, while large doses inhibit this function There is likewise some difference of opinion regarding the formation of X-ray tumors and the generation of monsters following strong irradiation Assuming that the process of the formation of

epidermoid cancers of all localizations, radiotherapy prolonged over a definite time to massive radiotherapy. The improvement of the therapeutic results has confirmed the correctness of this opinion.

(12) The biologic effects have no dosimetric significance independent of the time and can not serve to define absolute doses of radiation.

(13) The conclusions relative to the relations between the doses and the thresholds of biologic effects have validity only for the qualities of radiation which are effectively utilized.

B J DF LAUREAL, MD

The Fractional X-ray Dose H C Menkel Antiseptic, July, 1931, XXVIII, 523-525

Holzknecht, Sabouraud, Bordier, and others, for a considerable time, were in favor of the massive dose unit in the application of X-ray therapy. In the last few years, however, there has been some reversion to the smaller dose and more frequent exposures. Holzknecht definitely abandoned his advocated massive dose and adopted the fractional dose technic. Experimental work has shown that more striking results have been obtained in the destruction of malignant tissue by the use of smaller and more frequent doses than by the application of a single massive dose. It has also been shown in humans that tumors which no longer reacted did so when the dose was distributed over several days. The theory rests on the fact that division of cells ceases immediately after irradiation, this condition persisting for several days, when division again occurs. The cells at the time of division are particularly sensitive to the X-rays and if one is fortunate to again irradiate at the proper time, the effect is from two to three times as great as when the total dose is given in one sitting.

The author concludes that biologic experiments have indicated along what lines the future treatment of cancer should progress. There is no doubt but that X-rays produce results and that correct technic is essential, but it is the knowledge of the pathology

of cancer which will lead the way to the proper treatment of this disease. It should be remembered that cells are most susceptible to the influence of the X-rays at the stage of transition or mitosis. It is likewise essential to bear in mind that it is the absorbed rays which produce the desired therapeutic effects.

J N ANÉ, MD

THE ESOPHAGUS (DIAGNOSIS)

Epithelioma of the Esophagus in Association with Achalasia of the Cardia Geoffrey Rake *Lancet*, Sept 26, 1931, CCXXI, 682, 683

As a result of achalasia there is intermittent irritation of the esophagus. The condition of epithelial hyperplasia often occurs with production of definite papillomas. As irritation continues, these become malignant. In fifteen fatal cases, three deaths were due to malignant growths from ulcerated areas, resulting in cases of achalasia.

Prophylaxis consists of diet and a régime, as advised by Hurst, and emptying of the dilated esophageal sac by mercury bougie. Cases having papillomatous growths should have a periodic esophagoscopic examination.

F L GRANDSTAFF, MD

Roentgen Diagnosis of Varices in the Esophagus R Hjelm Acta Radiologica, 1931, XII, No 66, 15, IV, 146-151

The author first discusses the cause of esophageal varices. The portal vein drains the stomach, intestine, and spleen. Any obstruction in the portal vein causes congestion, which, in turn, results in dilatation of the anastomotic vessels. The collateral splenic veins are small and poorly developed, the most important of them coursing through the gastrosplenic and splenorenal ligaments and emptying into the lower esophageal veins. These esophageal veins also act as collaterals for the stomach veins. Hence, in portal obstruction these veins frequently become greatly enlarged, even reaching the size of a lead

In the group which had received medium irradiation the degenerative changes in the nuclei and swelling of the cell bodies were more marked. In the strongly irradiated group the swelling of the cell bodies was marked, those lying together appearing as if sutured, and the arrangement of the cells presented evidence of abnormality.

The degree of disturbance observed by the author in these experiments was not proportional to the amount of irradiation. This is explained by variations in sensitivity of the individual cells constituting the tissues in the seeds. In this experiment it was also observed that the deeper layer of cells was more markedly affected than the outer layer. This was due to the fact that the sensitivity to X-rays was greater in the deeper layer of cells, in which mitosis was more marked. It was noted also that the first evidence of the effects of irradiation was observed in the chromatin of the nucleus. The author believes that the abnormality in arrangement of the cells is not the immediate effect of irradiation but is secondary to the degenerative changes in the nucleus and cell-body, due to X-rays.

J N ANÉ, MD

Tumor Immunity The Effects of the Eu- and Pseudo-globulin Fractions of Anti-cancer Sera on Tissue Cultures Thomas Lumsden Jour Path and Bacteriol, May, 1931, XXXIV, 349-355

The author had previously developed an anti-cancer serum by inoculating cancer of one species (*e.g.*, man) into a heterologous animal (*e.g.*, sheep). When this was applied to tissue cultures of normal and malignant cells taken from an animal of yet another species (*e.g.*, mouse or rat), the malignant cells were killed in a few minutes while the normal cells survived and continued to grow. When, however, a sublethal dose of such serum was inoculated into the general circulation of a cancerous mouse or rat the cancer was little, if at all, affected. The reason for this was that the anti-cancer serum became too much diluted by the body fluids.

Only by stopping the circulation in the tu-

mor and injecting the serum was it possible to repeat *in vivo* the results obtained *in vitro*. After successful treatment of an implanted tumor, the cured animal became highly resistant to subsequent implantation of tumor cells.

It was later pointed out that the serum of an animal frequently inoculated with fragments of heterologous cancer contains three factors toxic to the cancer which was used as an antigen.

(1) Heterotoxin which is lethal to all heterologous cells. This is normally present in the serum of untreated animals.

(2) Anti-malignant-cell bodies having a specific affinity for cancer cells.

(3) Anti-species bodies lethal to normal as well as malignant cells of the species from which the cancer used as an antigen was taken.

By fractioning anti-cancer serum, the heterotoxins and anti-species bodies can be removed or destroyed, so that the resultant euglobulin fraction is ten times less toxic to mice, although it has lost none of its toxicity to the cancer cell.

It is considered that these experiments demonstrate beyond reasonable doubt the existence of anti-bodies having a specific affinity for cancer cells.

E C VOGT, MD

Comparative Investigations on the Effect of Bucky and Roentgen Rays on Cell Division G Politzer and J Zakovsky Strahlentherapie, Sept 12, 1931, XLII, 165-170

Salamander larvæ, about fourteen days old, were placed in small glass dishes on moist filter paper. Then the larvæ were exposed to Grenz rays at 10 cm distance. Every three minutes they were rinsed in cold water in order to prevent changes due to increased temperature. The tube was operated at 10 KV and 10 ma, the duration of exposure varying between five and twenty minutes. The output of the tube was 150 r per minute. Histologic studies of the irradiated larvæ

such conditions is better studied in the immature tissues of plants, the author irradiated the seeds of the *Vicia faba*. From $\frac{1}{3}$ E D to $6\frac{2}{3}$ E D were administered after the seeds had been steeped in water and sown in saw-dust. At a definite time following irradiation the seeds were fixed in paraffin and serial sections were made and examined. These were compared to normal non-irradiated seeds prepared in a similar manner.

The experimental results summarized were as follows:

(1) Strong and medium irradiation produced the same biologic changes.

(2) The development and growth of the root were disturbed and the tip had the appearance of permanent tissue.

(3) The most marked changes were observed at the vegetation point, which was abundant in immature cells, and which showed after irradiation many multinuclear giant cells.

(4) The earliest and most marked changes appeared in the nuclei of the cells, which showed the greatest swelling, shrinkage, and destruction from three to five days after irradiation.

(5) Mitosis was rarely observed and, when seen, appeared irregular and asymmetric.

(6) The changes in the cytoplasm were observed relatively later and consisted of the appearance of granules and large vacuoles.

(7) The cell bodies showed marked swelling and inequality in form and irregularity in arrangement.

The radiosensitivity of plant tissue was found to differ markedly. Generally, it may be considered that the more immature the cells, the more vivid the reproduction, and the more persistent the mitosis, the greater becomes the radiosensitivity, as was demonstrated by Bergonie and Tribondeau. The author concludes that the irregular arrangement of plant cells and the formation of deformity result after strong irradiation because of the difference in radiosensitivity of the individual cells.

J N ANE, M D

tion Gundo Boehm Ztschr Biol, 1931, XCI, 203-214

The physiologic swelling of resting muscle is due to the over-infiltration of water between the micelle. Isotonic contraction leads to their deformation, which results in interference points in the roentgenograph.

CHEMICAL ABSTRACTS

Investigation of the Histologic Change in Plant Shoots Caused by X-rays Especially the Effect upon the Arrangement of Tissues in the Seed of *Vicia Faba* K Narimatsu Japanese Jour Obstet and Gynecol, February, 1931, XIV, 50-57

Using the seeds of *Vicia faba*, the author studied the effects of the X-ray upon cell arrangement. The dry seeds were soaked in water for from 24 to 48 days before irradiation, then sowed upon a moist saw-dust bed and allowed to send out the principal roots. Those which had sprouted were then placed upon a level glass dish, which was covered with white paper to prevent the seeds from being dried and killed. The dish was then so placed under the X-ray tube that irradiation was evenly distributed. The factors employed were as follows: 140-150 K V P, 2 ma, distance 17-20 cm, duration, 15-60 minutes, no filter, shortest wave length, estimated by the Mark IV spectrometer of Marsch, Stauning, and Fritz, 0.084 Å E - 0.092 Å E.

The irradiated seeds were sown upon a moist saw-dust bed and from three to nine days later were fixed by Flemming's method, Boan's liquid, or formalin solution. Then a series of paraffin specimens were made and stained with hematoxylin eosin, lithium carmine, and by Flemming's solution.

Examination of the sections of the seeds which had received weak irradiation showed no marked abnormality in the cell arrangement as compared with the non-irradiated group. The most marked changes were produced in the nuclei of the cells. Mitosis decreased, the boundaries of the nucleus became indistinct, and the shape of the nucleus changed. In some cases the nucleus was so completely atrophied that the cell-body appeared as if it consisted of protoplasm devoid of a nucleus.

In the group which had received medium irradiation the degenerative changes in the nuclei and swelling of the cell bodies were more marked. In the strongly irradiated group the swelling of the cell bodies was marked, those lying together appearing as if sutured, and the arrangement of the cells presented evidence of abnormality.

The degree of disturbance observed by the author in these experiments was not proportional to the amount of irradiation. This is explained by variations in sensitivity of the individual cells constituting the tissues in the seeds. In this experiment it was also observed that the deeper layer of cells was more markedly affected than the outer layer. This was due to the fact that the sensitivity to X-rays was greater in the deeper layer of cells, in which mitosis was more marked. It was noted also that the first evidence of the effects of irradiation was observed in the chromatin of the nucleus. The author believes that the abnormality in arrangement of the cells is not the immediate effect of irradiation but is secondary to the degenerative changes in the nucleus and cell-body, due to X-rays.

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showed that Grenz rays produce exactly the same injuries on cell division as ordinary roentgen rays. It is concluded, therefore, that any difference in the therapeutic effect of Grenz rays cannot be due to any specific action but must be explained on the basis of the absorption law.

ERNST A. POHLE, M.D., Ph.D.

Investigations on the Bactericidal Action of Tissues of Healthy Animals and Those Radiated with X-rays G. M. Antonioli
Strahlentherapie, 1931, LXI, 496-509

The author concludes the following. A weak irradiation of guinea pigs with X-rays increases the bactericidal action of tissues and organs. An intensive irradiation of guinea pigs by strong and frequent doses of X-rays causes a considerable decrease in the germicidal power as compared to the control animals. These biologic changes of the action of X-rays are limited to the reticulo-endothelial cells. The difference of the germicidal action of various tissues and organs of radiated and non-radiated animals can only be explained by the uneven distribution of the reticulo-endothelial system in the animal tissues and organs. The author's experiments prove that small doses of X-rays influence the germicidal action of the reticulo-endothelial system favorably. Large doses, however, react most unfavorably.

CHEMICAL ABSTRACTS

Measurement of the Amount of Mesothorium and Radiothorium in Encapsulated Preparations of Radium Rolf M. Sievert and Ernst Olsson. Acta Radiologica, 1931, XII, No. 66, 15, IV, 121-134

Because the use of very large quantities of radium salts is becoming more and more common in medical practice, it is important to develop a method of measuring the amount of mesothorium and radiothorium in these preparations of radium. The authors of this paper have worked out such a method, based on principles earlier described by Bothe and by Hahn. It is based on the variation in the ab-

sorption of the gamma-rays from Radium C, Mesothorium II, and Thorium C by lead filters of different thickness. It can be used without opening the radium container.

The authors describe in detail their experimental work and the various preparations of radio-active substances measured and used as standards. Tabulations and graphs showing the absorption coefficients of the several radio-active substances studied are incorporated in the paper.

These methods may be used in (1) The determination of the mesothorium content of freshly made preparations containing both radium and mesothorium, (2) the determination of the amounts of radiothorium and mesothorium in such preparations (provided that the quantity of radium present is known) and of the approximate age of these preparations, and (3) the determination of the radium content when the proportion of the radiothorium to the mesothorium is known, e.g., from the age of the preparation. The accuracy of these measurements is greatly influenced by the age of the preparations, but the method is nevertheless usually reliable for detecting any considerable amounts of mesothorium and radiothorium.

A. L. HART, M.D.

THE EYE (DIAGNOSIS)

The Effect of Roentgen Irradiation of the Sympathetic Nerve upon the Eye Hans Salinger and Rudolf Thiel. Strahlentherapie, Sept. 12, 1931, XLII, 96-112

In order to study the response of the sympathetic nervous system to roentgen rays, the authors exposed the ganglion cervicale supremum and the centrum ciliospinale in patients with and without increased intra-ocular pressure. The technic for the irradiation of the ganglion cervicale supremum was as follows. The central ray was directed perpendicular over the center between the angle of the jaw and lower margin of the auditory canal. One-third H.E.D. was applied on the skin (170 KV, 4 ma, 0.5 mm Cu, 30 cm F.S.D.). The exposures were given at eight-day intervals not more than three times. The

intra-ocular pressure was determined with the patient prone on the treatment table before irradiation and immediately afterwards—later at certain intervals. The tonometer of Schiotz was used. The exophthalmos was measured by means of the exophthalmometer of Hertel, while widths of the pupil and the interspace between the lids were determined by the keratometer of Wessely.

In patients with glaucoma the pressure curves of both eyes showed a very characteristic appearance following unilateral irradiation of the ganglion cervicale supremum and the centrum ciliospinale. Following a preliminary increase, there was a definite drop in the pressure lasting several days and being followed by a gradual increase. The curves in both eyes run parallel, i.e., the pressure of the eye on the non-irradiated side changes identically with that of the eye on the irradiated side. In persons with normal eyes the fluctuations were very small. Protrusion of the eye bulb, dilatation of the pupils, and increase of the interspace between the lids were observed and considered as symptoms of sympathetic stimulation. The authors believe that their observations can be considered as proof of the effect of roentgen rays on the vegetative nervous system.

ERNST A POHLE, M D, PhD

Radiography of the Optic Canals R Cassou Bull et Mém de la Soc de Radiol Méd de France, May, 1931, XIX, 225-229

The author has developed a technic for easily and repeatedly demonstrating the optic canals. He finds that the average inclination of the optic canals lateralward from the sagittal plane of the head is from 30 to 35° and the caudal inclination is 15° through a horizontal plane passing through the glabella of the forehead.

The optic canals are situated intracranially at the summit of the orbital pyramid, they must be oriented and radiographed separately. The central ray must be projected in the central axis of the optic foramina.

The patient is placed prone on a table, the glabella and nose in contact with the film, the tube is inclined lateralward 30° and caudal-

ward 15° from the midpoint of the glabella. An exposure is made, the film changed, the tube is then shifted to the opposite side of the head and an exposure made of the opposite optic canal. The author suggests a focus-film distance of 60 cm, and a small cone of X-rays

CHARLES S CAPP, M D

**GASTRO-INTESTINAL TRACT
(DIAGNOSIS)**

Observations of Clinical, Anatomic and Radiologic Natures in a Case of Chronic Ileocecal Invagination of the Colon S Famulari Minerva Med, Nov 3, 1930, XXI, 643-649

This article is essentially a description of a case of ileoceco-colic invagination. The author draws from this study the following conclusions:

(1) The clinical signs of invagination are not always present at the beginning of the process.

(2) Its symptomatology may be very similar to that of other intestinal diseases.

(3) Its duration may be protracted over a long period of time during which signs of an apparent cure may arise.

(4) A neglected chronic invagination always results fatally.

(5) It is possible to reconstruct chronologically the different stages in evolution of an invagination only through accurate studies of clinical, anatomic, and radiologic nature.

L MARINELLI

Fixation of the Iliac Colon by Acquired Bands Radiological Demonstration Alfred C Jordon British Jour Radiol, August, 1931, IV, 387-390

The author believes it possible, by barium enema study, to demonstrate the rather frequent occurrence of acquired bands about the iliac colon. These he considers are the result of constipation. As bands form, the mobility of this part of the colon is restricted, stasis,

inflammation, and narrowing occur, and the results are stasis and dilatation in the proximal colon. The author states also that the abnormal fixation of the iliac colon is a primary factor in the causation of gastric and duodenal ulcer, also that the colon stasis is a factor in the causation of carcinoma of the bowel.

Evidence of band formation consists in showing a delayed filling of the iliac colon, with over-distention of the rectum and pelvic colon. The meal finally trickles through the fixed iliac colon and into the descending colon, the latter part showing dilatation with the iliac colon narrowed. The enema can is then lowered and delay in emptying of the barium from the bowel above the pelvic colon is seen. Apparently, therefore, the diagnosis of bands and kinks rests more on the demonstration of stasis than on lessened mobility.

J E HABBE, M D

Heterotaxia and Incomplete Transposition of Viscera Isaac Natín Semana Méd, June 19, 1930, XXXVII, 1560-1570

Two cases, one of heterotaxia and one of incomplete transposition, were attended by the author, the first one seeking treatment because of pulmonary tuberculosis and the second one because of typhoid fever. The first case had a total transposition as proven both radiologically and at autopsy. In the second case, transposition of the heart, spleen, liver, and stomach was found. The colon, as seen radiologically, did not present any transposition but showed slight deviation from the normal. Neither case had any symptoms referable to its malady. The anomalies of these two cases were found accidentally, and the author presents them because they comprise rare conditions.

N G GONZALEZ, M D

Marked Gastro-intestinal Hyperthyroidism Report of Thirty-four Cases J Russell Verbrugge, Jr Jour Am Med Assn, Aug 22, 1931, XCIVII, 513-517

The thyroid can play an important part in the production of gastro-intestinal symptoms

without giving the usual thyroid syndrome and without demonstrable enlargement of the gland.

Thirty-four cases recognized in a period of three years are analyzed, and four individual case reports are reviewed.

Phenobarbital and compound solution of iodine, as medication, with advice as to rest, diet, mental attitude, and other therapeutic measures, were sufficient in the majority of patients. Nine of eleven treated by radiation were either greatly improved or apparently cured.

C G SUTHERLAND, M B (TOR.)

X-ray Findings in the Gastro-intestinal Tract Julius Gorinskell Med Bull Veterans' Administration, September, 1931, VII, 845, 846

The author discusses briefly the X-ray examinations of the gastro-intestinal tracts of ex-service men and the pathologic conditions most frequently observed in this group of patients.

With the exception of one case of esophageal stricture, no pathologic condition was encountered in the esophagus. Duodenal ulcer was the most frequent finding in the stomach and duodenum. Gastric ulcer and gastro-enterostomy were also quite common. One case of the author's series showed evidences of both ulcer and newgrowth formation. A frequent finding in the colon, which was observed in from 80 to 90 per cent of cases, was a spastic colon, usually seen in the transverse and descending segments.

J N ANÉ, M D

GENITO-URINARY TRACT (DIAGNOSIS)

Calculus Obstruction of the Ureter—Observations Based on an Experience of 120 Cases W Calhoun Stirling Urol and Cutan Rev, September, 1931, XXXV, 547-551

The author divides calculus obstruction of the ureter into the following classes. Those in which impaction is partial, and those cases

in which the ureter becomes completely blocked While complete obstruction may or may not result in dilatation and infection of the kidney pelvis, intermittent obstruction with its resultant renal back pressure frequently produces complete destruction of the kidney

The four most commonly accepted causes of the formation of kidney calculi are as follows (1) Bacteria, (2) colloidal imbalance, (3) vitamin deficiency, (4) urinary stasis The salts of uric acid and urates have been found to constitute about 75 per cent of the stones removed Calcium oxylate and the phosphates occur in smaller proportions The opacity of a stone depends on its atomic weight The 5 to 10 per cent error in ureterography is made up by the uric acid, cystin, and similar stones which cast no shadow Occasionally a stone will be superimposed on the bony pelvis and be overlooked

Approximately 75 per cent of calculi become impacted in the lower ureteral segment, 15 per cent in the upper ureter, and the remainder in the iliac portion In the author's series stones were found in both ureters in 8 per cent and recurrences resulted in 5 per cent

Pain was the outstanding symptom in 89 per cent of cases in this series Nausea and vomiting were present in 29 cases and were reflex in origin Hematuria occurred in 53 cases of the author's group The preliminary routine roentgenogram frequently showed many small opaque shadows near the ureteral orifice which usually represented calcified glands In cases presenting symptoms it is advisable to pass an opaque catheter to positively identify these small shadows, and if further confirmation is desired a ureterogram may be done

The treatment of ureteral stone depends upon the following factors The size, shape, number, and location of the stones, amount of renal infection, the function, duration of impaction, tolerance to cystoscopic manipulation, the age and general condition of the patient, amount of pain, and the degree of fever The author believes that wherever possible conservative treatment should be tried first

J N ANÉ, MD

Strictures of the Ureter W Mulvehill
Am Jour Surg, August, 1931, XIII, 256-262

The author believes stricture of the ureter to be present more frequently than some writers claim He is of the opinion that there are various stages in the pathology of stricture which may render it difficult to diagnose

The end-results of ureteral stricture may be (1) Essential hematuria, (2) hydronephrosis, (3) pyonephrosis, (4) pyelitis, (5) urinary calculi, (6) some medical nephritides, and (7) much of the pathology in congenitally malformed kidneys and many so-called bladder neuroses The etiology is due to the common pyogenic organism No case of gonococcus infection as the cause was demonstrated in this study

Hunner does not believe inflammation of the tubes and ovaries plays a part in ureteral stricture Scott Pugh states that while seminal vesiculitis may be a cause of ureteral obstruction it is never the factor in the formation of ureteral stricture

The author contends that most cases, not considering trauma, are due to hematogenous infection from distant parts of the body

The symptoms are chiefly dull aching, vague pain, backache, and frequency Bladder symptoms are entirely absent in 30 per cent of the cases

In the author's hands, the "hang" of the ureteral catheter has not met with much success in making a diagnosis, nor does obstruction to the introduction of a catheter mean stricture of the ureter

The most reliable method employed is pyelography Intravenous urography has met with the writer's favor in diagnosing ureteral stricture He believes that the dilatation below a stricture in the ureter may be due either to the improper filling with opaque solution at the time of pyelography or to the impairment of nerve supply of the ureter caused by the scar tissues of the stricture, and resulting in atony of the ureter

The treatment of ureteral stricture consists of dilatation He advocates the continuation of this procedure as long as the pain recurs and is relieved by dilatation Approximately

50 per cent of the author's patients were cured, and great relief, for some time at least, was reported in a far greater percentage

In the discussion which followed, Ferrier believed the author to be a little too enthusiastic in regard to the diagnosis of strictures of the ureter. He states that spasm and kinking very often simulate a stricture so that it is frequently necessary, in order to be absolutely certain that one is dealing with a stricture, to take one or two successive roentgenograms to prove that it is consistent and uniform in type, size, and shape.

DAVIS H PARDOLL, M D

Contribution to the Roentgen Diagnosis of Internal Biliary Fistula Gosta Gräberger *Acta Radiologica*, 1931, XII, No 66, 15, IV, 164-174

The author reviews the cases of spontaneous biliary fistulae reported in the literature. He states that fistulae between the bile passages and other organs have been recognized for more than a century and that they have been reported as connecting the biliary tract with the stomach, duodenum, colon, appendix, pleura, pericardium, urinary passages, and uterus. Until the last fifteen or sixteen years, diagnosis was usually made at autopsy.

This condition is not common. Roth, Schroeder, and Schloth reported only 43 cases of internal biliary fistula in 10,866 autopsies. Of these, 19 were between the gall bladder and duodenum and 16 were between the gall bladder and colon. The same relative frequency was found by Courvoisier and Naunyn and by Judd and Burden.

The commonest cause of internal biliary fistula is gallstones. Less frequent causes are (1) Gastric or duodenal ulcer, (2) carcinoma of the stomach, (3) carcinoma of the gall bladder, (4) cholecystoduodenostomy, cholecystenterostomy, or cholecystogastrostomy, and (5) chronic cholecystitis. Most of these fistulae, however, are late complications of cholelithiasis.

X-ray diagnosis of these fistulae depends on the presence of gas or barium, or both, in the biliary tract. It is possible, however, for ba-

rium to pass through the papilla of Vater into the bile ducts when a fistula does not exist. Filling of the ducts with barium in this way has been reported in eight or nine cases of chronic pancreatitis and in obstruction of the jejunum by pressure of a large gastric carcinoma.

The author describes a case of chronic gall-bladder disease in a woman 70 years old. At X-ray examination a fleck of barium was observed outside the duodenal cap in the gall-bladder region, as the barium distended the cap, the fleck became larger. After a few minutes the cap was seen to expel most of its contents back into the duodenum. Cholecystography, done a few days later, showed, instead of dye in the gall bladder, a collection of gas.

The article is illustrated by several excellent reproductions of films in which either barium or gas is seen in the gall bladder or biliary ducts.

In the ensuing number of *Acta Radiologica*, the author has a note on another case which showed gas and barium, apparently in the gall bladder. Cholecystography showed no visible gall-bladder shadow. When the stomach was examined, fluoroscopy showed barium and gas passing into the gall-bladder area. After three hours, when the stomach was empty, barium was still visible in the gall-bladder region, after 24 hours the gall bladder was empty. At operation a diverticulum from the lateral wall of the duodenum was found in the angle between the common duct and the duodenum.

A L HART, M D

GENITO-URINARY TRACT (THERAPY)

Intravenous Urography Hermon C Bampus, Jr. *The Journal-Lancet*, Jan. 1, 1931, LI, 10-13

It is doubtful if, however much the patient might so desire, urography after intravenous injection can replace cystoscopic examination except in individual cases. The amount of

infection in each kidney, determination of separate renal function, and condition of the vesical mucosa, are frequently indispensable. The greatest field of usefulness for intravenous urography is that in which the presence of a second kidney is in doubt, because only one ureter can be found by cystoscopic examination, or injection of one ureter is prevented by stone or stricture.

The determination of functional excretion of the dye is, at present, uncertain. Good visualization occurs not only as the result of good function but is also secondary to renal retention, on the contrary, many normal cases give very imperfect visualization. The causes of these confusing observations have not been fully determined.

W W WATKINS, M D

Use of Intravenous Uroselectan in Trauma of the Urinary Tract Report of a Case of Ruptured Kidney Ben Earle Fillis Urol and Cutan Rev, September, 1931, XXXV, 567, 568

The author reports a case of ruptured kidney in which uroselectan was found valuable in diagnosis and in eliminating peritoneal rupture of the urinary bladder.

The patient, 16 years of age, in moderate shock with symptoms of chilliness, hematuria, nausea, vomiting, and severe pain in left renal and bladder areas, was admitted to the hospital. The history was that of trauma resulting from a hard tackle during a football game four hours previous to admission. Examination at the hospital revealed the following: temperature, 98.4 degrees, pulse, 90, respiration, 20, tenderness of the left upper and lower quadrants of the abdomen, with moderate rigidity of the lumbar and abdominal muscles in this region. Urinalysis revealed bloody urine, with albumin, and red and white blood cells. Blood examination showed a leukocytosis.

The patient was treated for shock and then administered uroselectan intravenously. The resulting uograms revealed a normal right kidney pelvis and vague left renal pelvis. The cystogram was normal and cystoscopy was

negative, except for the ejection of bloody urine from the left ureteral orifice. Indigo carmine, injected intravenously, appeared at the right ureteral orifice six minutes after injection. A diagnosis of complete rupture of the left kidney, with extra-renal and intrapelvic hemorrhage was then made and the patient was given expectant treatment, with frequent blood and urine examinations serving as guides. The subsequent course was uneventful, and the patient, without pain but not entirely free from hematuria, left the hospital on the fourteenth day.

J N ANE, M D

Intravenous Pyelography Carlos Heuser Semana Méd, June 19, 1930, XXXVII, 1605-1608

The author introduces in this article a device which he used for injections for intravenous pyelography. By means of this device, he draws some blood into a bottle and then the fluid to be injected is mixed with it and injected into the patient. The purpose of this is to prevent the formation of scars which occur as a result of extravasation of uroselectan and pyelognost. By avoiding such accidents, the only discomforts that patients may suffer are headache, pain in the shoulder, burning in the throat, and other minor sensations. He presents a case of a patient complaining of pain in the right kidney region, hematuria, and incontinence of urine. Intravenous pyelography was performed and only the left kidney and ureter were found outlined. By serial radiographs, it was found that the left kidney drained well, while the right one did not drain at all.

N G GONZALEZ, M D

GYNECOLOGY AND OBSTETRICS

Casuistics of Cured Sarcoma of the Uterus A Herzog Strahlentherapie, Sept 12, 1931, XLII, 198-200

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nancies and two miscarriages, the last pregnancy had been ten years previous to the examination Menstruation was regular until she was 48 years old From then on the periods were irregular and decreased She was curetted in January, 1925, the histologic diagnosis was cystic endometritis The bleeding stopped after that Beginning in January, 1926, the patient had bleed continuously She complained of hot flashes and pain in the lumbar region The uterus seemed slightly enlarged, but, because of an enormous amount of fat in the abdominal walls, could not be definitely outlined She was curetted and the histologic diagnosis of a polymorphocellular sarcoma made She refused operation and received X-ray therapy in February and May, 1926, and in March, 1927 At that time the uterus was as large as two fists and the left parametrium was definitely involved

Patient did not return until January, 1928, when she started bleeding again She desired operation, which was refused because of the inoperable condition The uterus was larger than on last examination and both parametria were now involved X-ray therapy was given in January, 1928 In March, 1928, the uterus as well as the adnexa appeared normal In October, 1928, she received additional X-ray therapy However, the patient started to bleed again and the uterus began to enlarge Under spinal anesthesia, the radical removal was carried out in November, 1928 Histologic examination verified the diagnosis made in 1926 The patient recovered well from the operation and four weeks later resumed her occupation as midwife She was last seen in July, 1931, still well and without recurrence

ERNST A POHLE, M D , Ph D

Studies on the Mineral Metabolism during Pregnancy and Lactation, and its Bearing on the Disposition to Rickets and Dental Caries Kirsten U Toverud and Guttorm Toverud *Acto Pediatrica*, 1931, XII, Supp II, 1-116

In order to study the predisposing factors to rickets and dental caries, 69 salt metabolism experiments were performed on 30 expectant mothers

The total calcium, phosphorus, and magnesium intake was determined for periods of four days during the last three months of pregnancy The effects of diet and cod liver oil on the inorganic elements in the blood as well as in the breast milk were studied

Dog experiments were also carried out in which the maternal metabolism as well as that of the young was determined

The authors conclude that a negative calcium and phosphorus balance in women is often demonstrated during the latter part of pregnancy, and also, less frequently, during lactation The cause of this negative balance is chiefly deficient mineral content in the everyday diet Vitamin D deficiency may also play a rôle The mineral and vitamin deficiencies in the diet during pregnancy and lactation predisposed offspring to rickets and dental caries The prevention of these diseases ought to be started in fetal life

An extensive bibliography is appended The article is published in English

E C VOGT, M D

X-ray Pelvimetry Dharendra Nath Banerjee and Gonesh Chandra Mukherjee *Antiseptic*, July, 1931, XXVIII, 518-522

Until recently, radiology played a very small part in diagnostic gynecology, the diagnostic use of the X-ray being limited in obstetrics to the determination of the presence or absence of the fetal skeleton A few roentgenologists, however, as early as 1900, attempted to estimate the diameters of the pelvis The various techniques which have been employed for this purpose are reviewed and discussed

The authors' method consists of a combination of the various procedures which have been suggested The method of Thoms is employed by placing the symphysis pubis and the spine of the fourth lumbar vertebra in the same plane, as measured by the pelvimeter from the surface of the Potter-Bucky diaphragm The tube is then centered on the intersection of the line joining the anterior superior iliac spines and midline of the body To

eliminate the necessity of mathematical corrections, because of magnification, a flat brass rod, perforated at intervals of one centimeter, with smaller holes at five millimeters, is employed. This is placed over the thighs at the level of the symphysis in the anteroposterior position and along the spine at the level of the spinous processes of the lumbar vertebrae in the lateral position. In the lateral roentgenogram the promontory of the sacrum is distinctly seen, but the symphysis pubis is often difficult to localize. The authors claim fairly accurate measurements of the pelvis, employing this method.

J N ANE, MD

Radiation in Pelvic Disease John F Herrick. Jour Iowa St Med Soc, February, 1931, XXI, 63-66

The author concludes a general discussion with this summary. The first requisite is a correct diagnosis; radiation treatment must be carefully controlled and measured by one well qualified. Cases must be carefully selected. Usually radiation is contra-indicated in acute inflammatory disease of the pelvis. Ovarian tumors are not usually suitable for radiation, except in malignant disease, when radiation before and after removal is indicated. Radiation is the treatment of choice in uncomplicated fibroids in women between 38 and 50 years of age. Cancer of the cervix is best treated by radiation, both in cure and prevention. Cancer of the body will yield to radium as certainly as to surgery.

W W WATKINS, MD

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Concerning the Universal Thoracic Pulsation Manuel del Sel and Alberto C Taquini Prensa Méd Argentina, July 30, 1931, XVIII, 255-259

The author presents a case of posterior aneurysm of the transverse and descending arch of the aorta. The clinical diagnosis was

based mainly on the thoracic pulsation, which the author attributes to an advanced aneurysm with destruction of the thoracic wall, causing a movement of expansion. The diagnosis was confirmed with fluoroscopy and radiograms. He concludes that such a posterior aneurysm can be diagnosed clinically through this pulsation, instead of relying entirely on X-rays, as has been the custom.

N G GONZALEZ, MD

Clinical and Radiologic Contributions to the Study of the Azygos Vein Lorenzo Crosetti. Minerva Med, Apr 21, 1931, XXII, 606-614

In reviewing the embryologic theories pertaining to the origin of the azygos vein and the literature existing on the subject, the author points out that both statistics and interpretation of radiographs are somewhat contradictory. He describes and criticizes in detail the various technics used and enumerates those which are most likely to yield satisfactory results. This article includes five complete reports suitably illustrated which, incidentally, were the only ones occurring in 514 observations made at the author's clinic for the study of tuberculosis. Teleradiography was used, with exposures of one-tenth of one second.

The author believes that the difficulty encountered in the interpretation of a film is due either to the lightness of the opaque band of the meso-azygos or to its unusual location, and that it is very easy to mistake the image of the vein for shadows of old sclerotic lesions or calcified nuclei. The anomaly may cause an hypophonia of different intensities in the corresponding apical field. This sign should be of further aid to the semeiotic control, but it must be confirmed by appropriate radiologic examination.

L MARINELLI

HODGKIN'S DISEASE (THERAPY)

Four Cases of Hodgkin's Disease Treated with Radium H E Guerrero New Or-

leans Med and Surg Jour, April, 1931, LXXXIII, 698-705

In the cases reported, only the cervical glands were involved, the swollen glands being treated with radium in conjunction with which Fowler's solution was given. The masses uniformly decreased in size and pain disappeared. Such lesions are very difficult to differentiate from tuberculous adenitis, lymphosarcoma, and leukemia in its aleukemic stages.

W W WATKINS, M D

The Disappearance of Tuberculin Energy in Patients Afflicted by Malignant Lymphogranuloma who have Undergone X-ray Treatment Cesare Rotta Minerva Med, April 21, 1931, XXII, 601-606

The author presents the complete clinical reports of five patients suffering from Hodgkin's disease, whose reaction to 1 per cent solution of Meister-Lucius tuberculin was negative before X-ray treatment and positive afterwards. He also mentions two similar cases which occurred to Professor Micheli. The tests were performed immediately before the cycle of treatments, and a month after the end of it. The doses of radiation given were very large in all cases and varied from a minimum of 2,000 r to a maximum of 6,000 r.

The author advances the hypothesis that roentgen treatment has brought the patients to the relatively normal state of positive reaction found in most individuals.

L MARINELLI

THE KIDNEY

Acquired Renal Dystopia or Movable Kidney Frank Kidd Jour Urology, September, 1931, XXVI, 327-378

The types of renal dystopia are reviewed and a fresh hypothesis is formulated which attributes the most important pathologic type to the persistence from neolithic times of a racial stock of Egyptian origin and descent. The importance of the intra-abdominal pressure is minimized, and the significance of the suspensory ligaments of the kidneys are emphasized. The pathology of movable kidney

is placed on a fresh plane, being brought into line with the pathology of sprains and deformities. Pyelography is advocated as the only real guide to treatment, and as the indicator of the reasons for success or failure of operations. An operation for renal dystopia is described, and the points essential for success in operating outlined.

Brandsford Lewis' discussion of the author's paper dwelt in particular on the evidence of stasis in the pelvis and the emptying time of this organ. He also stressed the differential diagnosis.

Clyde Leroy Deming claimed that it is within the realm of every trained urologist to determine conclusively by cystoscopic and roentgenologic examinations, whether or not the nephroptotic kidney is the organ which is responsible for the clinical manifestations. The severity of the component manifestations, the functional disability of the kidney and its influence upon the adjacent organs determine the indications for surgical treatment.

Under indications, the following factors are to be considered:

- (1) Pain,
- (2) pelvic and ureteral stasis,
- (3) chronic pyogenic infections of the kidney,
- (4) ureteral kinks,
- (5) rotations and torsions,
- (6) traction on adjacent organs,
- (7) general visceroptosis,
- (8) aberrant vessels,
- (9) calculus,
- (10) neurasthenia, and
- (11) failure of palliative treatment.

The contra-indications for surgical treatment were stated as follows:

- (1) Movable kidney which does not give pain or shows no infection and has normal function and normal emptying time,
- (2) voluminous hydronephrosis,
- (3) enlarged liver and spleen,
- (4) stenosis of uretero-pelvic outlet,
- (5) large calculus with pyonephrosis,
- (6) tuberculous kidneys, and
- (7) non-surgical risks.

Deming described his operation for nephroptosis and his results.

William F Braasch said that the indications for operation are logical and sound. If they are followed, many operations for nephroptosis which are now being done, will be avoided. On the other hand, that there are indications for operation in a small number of carefully

selected cases is proved by the post-operative results which the author has secured and has demonstrated by means of urography

Oswald S Lowsley stated that the endocrine relationship to nephroptosis should be considered. Thorough mobilization of the kidney and ureter is essential for successful nephropexy. He stressed the importance of urography as a factor in the diagnosis. Palliative measures for one year are advocated. Every ptosed kidney should not be operated, general visceroptosis should be borne in mind. It is poor judgment to fix a badly damaged kidney which should be removed. It is equally inadvisable to operate on a ptosed kidney which is draining properly and is symptomless.

Thomas D Moore stressed the importance of serial pyelographic films during expiration and inspiration, in order to determine the degree of renal excursion, kinks, fixation, and other important data.

The author closed his paper by stating that one must pick his cases in order to get the wonderful results claimed for nephropexy. Palliative treatment should be tried first by all means.

At operation the kidney is anchored, not fixed. Very soon the adhesions made at operation once more begin to stretch and the kidney again takes on in a few weeks a definite and swinging action. This action is never as great as before operation and thereby the kidney retains its high position.

DAVIS H PARDOLL, M.D.

Influence of High Protein Diets on the Kidney R Klein and O Bergeim Proc Soc Exper Biol and Med, 1931, XXVIII, 590, 591

Various types of protein in a standard diet were fed to 36 rats in groups of 9. One rat in each group was killed by CHCl_3 after 19, 35, 70, and 135 days, the kidneys were weighed and examined histologically. Rats fed a diet of 75 per cent protein showed renal hypertrophy in 40 per cent of the cases. Rats receiving meat powder or keratin along with

60 per cent casein in their diets for from 35 to 135 days showed swelling of the tubular cells, degeneration of the nuclei, and many tubular casts. The changes were most marked in the group receiving meat powder. The indigestible protein of horn with its presumably accompanying intestinal putrefaction had no marked effect upon the kidneys. Predigestion of the casein, which should facilitate the absorption of amino acids, did not seem to influence the result.

CHEMICAL ABSTRACTS

MEDICAL PRACTICE

The Problems of Radiology in India P B Mukerji Antiseptic, July, 1931, XXVIII, 464-472

With the firm conviction that the practice of radiology should be recognized as a specialty in the practice of medicine and that the radiologist should be considered as a consultant and a specialist, the author discusses and suggests solutions of the many problems confronting radiologists in general and those of India in particular. The proper education of the medical profession and the public in this regard is believed of utmost importance.

The qualifications of a radiologist as summarized by Martin are as follows: (1) Possession of a degree in medicine from a recognized university, (2) a command of the best technical procedures used in diagnostic radiology, (3) a thorough knowledge and experience in roentgenographic interpretation, (4) a knowledge of modern medicine sufficiently broad to make him a true consultant, (5) a broad knowledge of radiotherapy with reasonable experience in this field, (6) the ability and willingness to teach, (7) some familiarity with research problems. The term "radiologist" should not be confused with "radiographer." A radiographer is a lay-assistant, a non-medical man, or a technician who knows how to handle X-ray equipment in order to obtain roentgenograms, or to carry on X-ray therapy when the dosage has been prescribed by a radiologist or a physician trained in the science of radiology. While

the technical work can be performed efficiently by a radiographer, the interpretation of roentgenograms and fluoroscopy in terms of pathology should be done only by a radiologist, who has a knowledge of pathology, clinical medicine, and surgery.

The author believes that if the X-ray department of a hospital is to be of real value, a radiologist should be in charge. The practice in many hospitals of adding the radiologic work to the duties of the already overworked medical officer does not lead to the best that can be obtained in the practice of radiology. It is absurd to expect general practitioners, such as medical officers in charge of hospitals, to keep abreast of all advancements and developments in a specialty of medicine, which is the most technical of medical specialties. The proper solution, in the author's opinion, is the placing of a radiologist in charge of the radiologic department.

The importance of roentgenology has often been improperly interpreted by the public and what is much worse, also by some doctors who believe or make their patients believe that with the aid of roentgenology all occult diseases may be diagnosed. On the other hand many clinicians regard radiology as a joke not worthy of their consideration, or request a roentgenogram made but desire to interpret it themselves, thus treating the radiologist as a photographer. Clinicians should require from radiologists what they expect from other qualified specialists, and the radiologist should be given the essential clinical data and if possible an indication of the clinician's opinion.

In almost all of the universities in India, with medical faculties, attendance at a course of from six to fifteen lectures in radiology is demanded of the students. The author believes that at least twenty lectures are necessary to impart to the students a satisfactory foundation in radiology. He further deplores the fact that there are professors in almost every branch of medicine in Indian universities except in radiology.

J N ANÉ, MD

gards Diagnosis and Therapy M D Joshi
Antiseptic, July, 1931, XXVIII, 449-463

Like all new discoveries and inventions, radiology has passed through the stages of ridicule, opposition, and suspicion, but it is now recognized as one of the most essential and important additions to our armamentarium of diagnosing and treating various pathologic conditions. Radiology does not deprive the practitioner of his acumen in diagnosis, for if properly utilized and interpreted, it serves rather to improve his methods of clinical diagnosis by enabling him to correlate more accurately the clinical data with the pathologic changes. The author considers it the duty of the radiologist to carefully investigate the clinical data before making a radiologic diagnosis.

The author discusses the preparation of the patient and the value of radiology in the diagnosis of diseases of the bones, joints, chest, alimentary and urinary systems, in gynecology, and in obstetrics. He further classifies and discusses therapeutic radiology.

Inflammatory affections of bones are characterized by the fact that there is no sharp demarcation line between the affected and normal portions of bone, and by the presence of periosteal reaction. Radiologic examination is particularly useful in detecting and locating sequestra. Tumors of bone are characterized by the presence of a sharp line of demarcation between the normal and involved bone and by the absence of periosteal reaction.

X-ray examination of the chest will demonstrate the following: (1) Affections of the ribs or thoracic vertebrae, (2) pathologic conditions of the pleura and pleural cavity, (3) consolidation, fibrosis, or cavity formation in the lungs, (4) conditions of the bronchi and hilum glands, (5) size and shape of the heart and aorta, and (6) enlargement of the thymus and mediastinal glands or mediastinal tumor.

In the study of the alimentary tract he recommends the use of barium sulphate in buttermilk as the opaque meal. Various pathologic conditions of the esophagus, stomach, duodenum, cecum, appendix, and colon may thus be studied and differentiated. The gall bladder is best examined after the

oral administration of sodium tetraiodophenolphthalein

X-ray and radium are employed in the therapy of many diseases which are intractable either to medical or surgical treatment. Generally, radium should be used for small localized lesions, whereas it is more convenient to give X-ray exposures on extensive lesions, such as secondary carcinoma. Besides their use for malignancy radium and X-ray therapy are useful in many other conditions, such as leukemias, tuberculous glands, fibroids, keloids, lupus, eczema, psoriasis, and rodent ulcer.

The author concludes that proper co-operation between the clinician, pathologist, and radiologist will make possible a much more rapid advance in radiology.

J N ANE, M D

MYOSITIS OSSIFICANS

Contribution to the Casuistry of Post-traumatic Muscular Ossifications I Bigliardi L'Ateneo Parmense, May-June, 1931, III, 160-168

The study of post-traumatic muscular ossifications, begun by Billroth, in 1872, may now be said to be complete, especially since, with the advent of radiology, we have been enabled to study this rather unusual lesion with detailed and prolonged observations to determine in part its origin, and to follow its clinical evolution.

Of particular interest is the radiographic study of muscular ossification. In the first period, soon after the trauma, there is noted the presence of a circumscribed and rather faint shadow somewhat more opaque than that of the muscular tissue and of much smaller volume than the palpable mass. This shadow, in successive examinations made at increasing periods of time after the trauma, takes on constantly greater opacity, with the formation of darker, intermingled with lighter, zones, since the neoformation is not the result of a single osseous mass, but often of various fragments

made up of connective tissue, muscular fibre, and adipose tissue.

This shadow finally assumes the characteristic skeletal opacity, then slowly retrogrades until there remains on the plate only a small, thin focus of ossification which soon entirely disappears.

The author studied four cases of post-traumatic muscular ossification in the Radiologic Institute of the Ospedale Maggiore, of Parma. The first two were cases of ossification of the brachial muscle. The first is of particular interest, in view of the precocity of the osseous neoformation observed within a period of ten days after the trauma. The third case showed ossification of the great lateral muscle, while the fourth report described a case of Pellegrini-Stieda's disease.

It is certain that at the present stage of science nothing is definitely known regarding the genesis of this species of ossification. The various theories expounded have been in part superseded, while others fail to withstand scientific test. Undoubtedly, that of Orlow satisfies better than any other the clinical tests and experimental results.

W W WHITELOCK, Ph D

NERVOUS SYSTEM (GENERAL)

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve Part I—The General Action of X-rays, Especially the Relation with Blood Pressure S Suzuki Japanese Jour Obstet. and Gynecol., June, 1931, XIV, 207-213

Experimenting with healthy female rabbits, the author studied the effects of X-irradiation upon the vegetative nerves as demonstrated by changes in the blood pressure. The factors used were as follows: Effective pressure, 150 KV, 2 ma, focal skin distance, 23 cm, no filtration, time, 35-40 minutes. An abdominal field 8 X 6 cm was selected and the remainder of the animal protected by 3 mm of lead rubber.

The highest blood pressure of the healthy control animals was found to vary from 86 to

108 mm Hg, with a pulse pressure of from 5 to 6 mm Hg. One hour after irradiation the blood pressures, as a whole, showed a very slight fall, but the pulse pressure increased generally and in some cases rose to 22 mm Hg. From two to three hours following irradiation there occurred a marked fall in blood pressure in all of the animals. The blood and pulse pressures returned to normal in from seven to ten days.

Comparisons of the effects upon the blood pressure of adrenalin in control and irradiated animals were also made. One hour after irradiation the rise in blood pressure following adrenalin was only slightly restrained. This antagonistic action to adrenalin was greatest from three to five hours following irradiation and persisted for from seven to ten days, at which time the normal conditions and reactions returned. It was possible also to abolish this restraining effect to the action of adrenalin at any time after irradiation by the administration of atropine.

Similar experiments were performed on healthy non-irradiated animals, using pilocarpine as a stimulant to the parasympathetic nerves, results similar to those noted in the irradiated series being observed in every case. The author, therefore, concludes that X-irradiation produces a hypertonic condition of the parasympathetic nervous system.

J N ANÉ, M D

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve Part II—Pharmacologic Investigation of the Effect of Irradiation on the Inferior Mesenteric Ganglion upon the Uterine Motion. S Suzuki Japanese Jour Obstet and Gynecol, June, 1931, XIV, 214-217

The author irradiated the inferior mesenteric ganglions of rabbits and studied the effects upon the uterus. Following laparotomy a lead cylinder was placed over the inferior mesenteric ganglion, and the remaining tissue, including the uterus and ovaries, were protected by a lead-rubber plate. The factors used were as follows: 150 KV, 2 ma, distance, 23 cm, no filtration, time, 35 minutes,

the shortest wave length, 0.78-0.80 Å. The drugs employed were adrenalin, pilocarpine, pituglandol, secacornin, and barium, which were injected into the auricular vein.

The day following irradiation the uterine tissue was found only slightly sensitive to secacornin and barium, but markedly sensitive to pilocarpine. From nine to eleven days following irradiation, marked sensitivity was noted to all the drugs employed. A decrease in sensitivity occurred from 20 to 21 days after irradiation, but from 28 to 30 days following X-radiation uterine excitability again increased, so that sensitivity was greater at this stage than at any other time. Microscopic examination of the irradiated inferior mesenteric ganglion revealed retrogressive changes. The uterine tissue showed evidences of congestion and development of glands of the muscular layer. Thus, the effects noted upon the uterus were secondary to those observed upon the ganglion. The author believes that the increased sensitivity to pilocarpine on the day following irradiation was due to the hypertonic condition of the parasympathetics, induced by the irradiation.

J N ANÉ, M D

The Radiosensitivity of Nervous Tissue A Zimmern and J A Chavany Strahlentherapie, 1931, XL, 482-495

The entire literature dealing with the biologic effect of radiation (roentgen rays and radium) on nervous tissue is critically discussed by the authors. It is regrettable that no bibliography of the quoted articles has been appended.

ERNST A POHLE, M D, Ph D

RADIATION

Complement Properties of the Blood Serum or Alexin Reaction Following Roentgen Treatment. J Heeren Strahlentherapie, Sept 12, 1931, XLII, 189-197

The serum of fifty patients was examined with the hemolysis reaction modified by

Huntemuller (see *Zentralblatt f Bakt*, CX, 150) The results are compiled in a table giving the diagnosis and reaction and also the dose applied in r units In the majority of patients, there were slight changes in the complement properties of the serum No uniform change could, however, be noticed There was no relation between the complement reaction and certain groups of disease

ERNST A POHLE, M D , Ph D

Concerning the Question of the Distribution of X-ray Intensity in the Body in Deep Therapy II—Fundamental Considerations

M Dorneich *Strahlentherapie*, Sept 12, 1931, XLII, 56-86

The author has continued his studies on the determination of isodoses, this paper deals with the errors involved in the photographic method of measuring X-ray intensities in a water phantom (See also *Strahlentherapie*, 1930, XXXVIII, 591) While it does not lend itself well to abstracting, the paper is recommended for study in the original to all those interested in the effect of roentgen rays on photographic emulsion for quantitative determinations

ERNST A POHLE, M D , Ph D

The Biological Effect of High Voltage X-rays Charles Packard and C C Lauritsen *Science*, March 20, 1931, LXXIII, 321, 322

The well known studies of Packard and Wood, on the killing effect of roentgen rays of various wave lengths upon the ovum of *Drosophila*, have been extended to an average wave length of 0.04 Å U, produced by Lauritsen's 550 KV tube in the California Institute of Technology The previous results, namely, that the same number of r-units applied produced the same biologic effect independent of the wave lengths was again confirmed for these hard rays produced with 550 kilovolts The same results were obtained with a mouse tumor (Sarcoma 180) The lethal dose was tested by inoculation of radiated small pieces into healthy animals A

number of tests with the particles radiated at 550 KV showed the lethal dose to be about 2,750 r This agrees well with the dose found by Wood by the same tests at softer rays (0.20 and 0.70 Ångstrom unit)

OTTO GLASSER, Ph D

Several Facts Concerning Cancer Tissue as Brought Out by Radiotherapy Cl Regaud Arch Rad Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 371-383

In a typical epidermoid epithelioma the cancerous tissue evolves between a zone of multiplication (ordinarily peripheral, and where the germinative cells are situated) and a zone of desquamation (ordinarily central and occupied by the squames which terminate the sterile cellular lines) In other cancers, the germinative cells and the cells of the sterile lateral lines are mixed In still others lateral lines are not found, all the cells appear fertile

The histologic study of the transformation of epidermoid cancer tissue treated by radiation demonstrates the following The disappearance of the germinative cells, the continuation of evolution of the cells of the lateral lines towards keratinization, the increase, then the resorption of the masses of squames, and temporary modifications in the population of the connective tissue

A series of analogous phenomena observed in the thymus treated by rays has shown that the corpuscles of Hassall are formations which are not permanent but variable

Everything leads to the conclusion that, in a non-irradiated epidermoid cancer, the clumps of squames (horny pearls) are formations which are not permanent but variable—whose volume at any moment represents a difference between their increase and their resorption

The internal life of cancerous tissues is not only a question of phenomena of increase, but also of phenomena of resorption, the increase in volume of the tumor is a measure of the

difference of intensity of these two phenomena

Holocrine secretion, of which cancerous tissues are the site, could furnish a plausible hypothesis for the explanation of the eventual acquisition of special properties by the serum of those afflicted with cancer

B J DE LAUREAL, M D

RADIATION SICKNESS

The Symptomatic Treatment of X-ray Sickness Following Roentgen Deep Therapy E B Huffer Strahlentherapie, Sept 12, 1931, XLII, 181-188

The author has treated a series of patients who received X-ray deep therapy with preparations usually prescribed in sea sickness One is called "vasano" and the other "nautisan" The first is a mixture of hyosciamin and scopolamin 3 1, and the second contains chiefly trichlorisobutylalcohols with an addition of caffeine He obtained good results in a high percentage of cases and recommends these drugs, therefore, in the prevention or treatment of X-ray sickness A combination of both did not improve the results

ERNST A POHLE, M D, Ph D

Roentgenotherapy and Cholesterol Content of the Blood Serum Colsil and X-ray Sickness Elisabeth Willms Strahlentherapie, Sept 12, 1931, XLII, 171-180

This study was undertaken to determine the cholesterol changes in the blood serum following irradiation, as well as the therapeutic value of colsil (cholesterol pills) in the prevention or treatment of X-ray sickness

It appeared that patients with malignant tumors usually had an increased cholesterol content in the blood serum, varying between 0.276 mg per cent and 0.484 mg per cent Twelve out of nineteen cases showed the increase in either normal or subnormal values Cholesterol determinations were also made before and after X-ray therapy No correlation could be established between the X-ray

sickness and cholesterol content in the blood serum If normal persons received colsil, the cholesterol content in the blood serum was higher and remained so up to twenty-four hours following the administration Of eight treated cases, four had X-ray sickness in spite of colsil, one patient who had the most violent attack of X-ray sickness had a higher cholesterol content in the blood serum than before irradiation

It is concluded, therefore, that the cholesterol changes in the blood serum are not alone responsible for X-ray sickness Colsil must not be considered of curative value in all cases but may help a certain group of patients

ERNST A POHLE, M D, Ph D

RADIUM

Physics of Radium and Radium Therapy M J S Pillai Antiseptic, July, 1931, XXVIII, 491-498

Radium therapy originated in 1901, as a result of the famous "Becquerel burn" Radium is a metal of the alkaline earths, similar to calcium, barium, and strontium Its atomic weight is 226.45 and its melting point is 700 degrees centigrade Alpha, beta, and gamma radiations are emitted simultaneously, their relative proportions being approximately 10,000 100 1

The alpha-rays of radium are atoms with a positive electric charge and are deflected by strong electric or magnetic fields Alpha-rays are absorbed by about three inches of air, or thin sheets of paper, metal, or rubber Beta-rays are similar to the cathode rays, but are more penetrating The hardest of these rays do not penetrate more than three-eighths of human tissue, 4 mm of aluminum, or 1 mm of lead Gamma-rays are similar to X-rays, although the hardest gamma-rays are more penetrating

The methods of application of radium are as follows Surface application, teleradiotherapy, and interstitial The author advises the careful preparation of the patient before employing radium therapy and suggests the

following precautions (1) All septic foci should be eliminated, (2) a red blood count of below 1,000,000 per cc is a contra-indication to radium application, (3) massive doses of radium should not be employed in the treatment of advanced lesions of the liver, kidneys, or heart, (4) in cases of lesions of the pelvis, situated deeply, a combined treatment of radium and deep X-ray therapy is more valuable than treatment with either alone, (5) the treatment of menorrhagia should be administered soon after the menstrual period ends, in order to avoid the usual reactionary excess which follows treatment, (6) in general, a diagnosis describing the exact pathologic condition of the involved tissue will prove valuable in the proper application of radium therapy

It has been established that some tissues are more easily controlled and destroyed than others. The response to irradiation is further modified by the nature of the resistance of the patient and the size, site, and condition of the tumor. In general, radiosensitivity is found to be greater in cells with greater reproductive capacity.

Very much brilliant work has already been accomplished in the study of radium therapy and its application. The author believes that the close co-operation of physicists, clinicians, radiologists, and pathologists will accomplish very much in adding valuable information to our knowledge of this form of therapy. He cautions against the dangers resulting from the use of radium by unskilled workers.

J N ANE, M D

ably There is no appreciable loss in potency if the activation is carried on to even as much as a 20-fold excess. There are some decomposition products formed in all cases.

CHEMICAL ABSTRACTS

RICKETS (DIAGNOSIS)

The Distribution and Frequency of Rickets in One of the Fishery Districts of Finnmark, and Relation of Diet to the Disorder
Johan Kloster *Acta Paediatrica*, 1931, XII, Supp III, 1-82

The data in this article were collected from the Vadsoe Medical District of arctic Norway.

The author records very careful clinical studies, as well as interesting general observations, to show that, contrary to the common belief, rickets is common among the children living in the arctic regions.

He found traces of rickets in 43 per cent of the children under seven years of age. In 7 per cent the rickets was especially distinctive. He found no cases of rachitis tarda. Congenital syphilis and scurvy are very rare in this district.

He goes, with considerable detail, into the factors which probably have a bearing on the prevalence of the disease, as diet, sunlight, climate, and conditions of habitation.

E C VOGT, M D

Activation of Ergosterol with Radium Emanation Richard B Moore and Thomas DeVries *Jour Am Chem Soc*, 1931, LIII, 2676-2681

Ergosterol can be activated with Rn to a degree of potency perhaps 0.01 of that of a good grade of ultra-violet-irradiated ergosterol. Stirring the sample while it is under the influence of Rn increases the speed of activation but does not increase the potency appreci-

The Absorption Spectra of the Blood and Their Relation to Rickets R C Gibbs, J R Johnson, and C V Shapiro *Strahlentherapie*, June 13, 1931, XLI, 161-168

The Absorption Spectra of the Blood and Their Relation to Rickets R Suhrmann and W Kollath *Strahlentherapie*, June 13, 1931, XLI, 169, 170

The authors of the first paper published the results of their studies of the absorption spectra in the blood of healthy chickens and

difference of intensity of these two phenomena

Holocrine secretion, of which cancerous tissues are the site, could furnish a plausible hypothesis for the explanation of the eventual acquisition of special properties by the serum of those afflicted with cancer

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ERNST A POHLE, M D , Ph D

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apy K P Mody Antiseptic, July, 1931, XXVIII, 512-517

While X-rays are somewhat similar to light waves, the wave lengths of the roentgen rays are so much shorter that their effects on human tissues are much more profound and powerful. X-rays are composed of rays of many wave lengths, the long waves having their maximum effect on the skin, and the short ones penetrating deeply. In this manner, the wave lengths are selected according to the nature and depth of the lesion.

A malignant tumor—being a purposeless, irrational, irregular reproduction of cells, serving no useful purpose, replacing, invading, and destroying healthy tissue—naturally does become a rather complicated problem. The cells are in various stages of division and reproduction and vary in their response to the X-rays, for some are radiosensitive and others are radioresistant. The X-ray dosage should be such that all of the pathologic cells are destroyed but the minimum danger done to the normal surrounding tissue.

Many methods are used to determine the X-ray dosage applied. The pastille method of Sabouraud while excellent for superficial therapy is unreliable in deep therapy. The skin tolerance dose method of the Germans is believed by the author to be of some value. However, individual variations in sensitivity to the rays occur which render the accurate estimation of the erythema dose difficult. In spite of inaccuracies, the author is of the opinion that the erythema unit dose method remains as the most practical method of dosage yet evolved. The use of the "sphere gap" and the iontoquantimeter of the French is also mentioned. The design of the latter type of apparatus is based on the fact that air, ordinarily a non-conductor, becomes a good conductor when the X-rays are directed on it. The determination of the "depth dose," which depends on the voltage, filter, and skin-target distance, is of great importance.

There is some difference in opinion regarding the period of time during which the full dose should be given. In some laboratories the total dose is given at a single sitting. The disadvantage of this technic is that it is very exhausting to the patient and in some cases

results in considerable disturbance to the general health. The French, on the other hand, divide the total dose into several sittings. The neoplastic cells are in different stages of division and reproduction and by applying divided doses it is hoped that all the cells may be destroyed during the radiosensitive phase.

J N ANÉ, M D

Outline of Roentgen Diagnosis (first paper) Leo G Rigler Journal-Lancet, Feb 15, 1931, LI, 143-147

This article is the first of a series on the subject, running in this journal. This paper covers the following points: (A) Nature and Value of Roentgen Examination, (B) X-ray Films—(1) characteristics of a roentgenogram, (2) factors affecting the production of an X-ray film, (3) common errors and confusing shadows, (4) technical facts of especial importance, (C) X-ray shadows in the body—(1) gas, (2) fat, (3) internal organs, (4) muscles, (5) blood-containing organs, heart, blood vessels, (6) calcium, (7) foreign bodies, especially metallic, (D) Aids to Examination—(1) general considerations, (2) introduction of air or other gases, (3) barium and bismuth salts, especially barium sulphate, (4) sodium iodide, etc., (5) iodized oil, (6) gall-bladder dye, (7) uroselectan, (E) Methods of Roentgen-ray Examination and Their Attributes—(1) films, (2) fluoroscopy, (F) Diseases and Organs which should be Examined with the Roentgen Ray as an Aid to Diagnosis—(1) osseous system, (2) the head, (3) respiratory tract, (4) heart and great vessels, and, to a lesser extent, all the arteries, (5) diaphragms, mediastinum, thymus, and thyroid, (6) gastro-intestinal tract, (7) gall bladder, (8) urinary tract, (9) genitalia, (10) pregnancy, (11) miscellaneous conditions, (G) Definition of Terms.

W W WATKINS, M D

Outline of Roentgen Diagnosis (second paper) Leo G Rigler Journal-Lancet, March 1, 1931, LI, 181-184

This paper considers the following: Bones

rats as compared with animals which have rickets, as observed by themselves and by Suhrmann Their results do not agree with those reported by the latter In a brief communication, Suhrmann and Kollath offer several explanations for the discrepancy

ERNST A POILLE, M D, Ph D

ROENTGEN DIAGNOSIS AND THERAPY

The Rôle of Radiography in the Diagnosis of Diseases of the Lung S K Basu Antiseptic, July, 1931, XXVIII, 510, 511

The author considers X-ray examination of the lungs superior to physical examination in the following conditions (1) Early tubercle complicated by bronchitis, (2) deep-seated and closed early lesions, (3) hilum tuberculosis, (4) recrudescence of old lesions, (5) necessity of application of artificial pneumothorax treatment successfully

It is emphasized, however, that in all cases a physical examination should be made and correlated with the roentgenographic findings

J N ANE, M D

Radiology in Diagnosis M Mukherji Antiseptic, July, 1931, XXVIII, 473-490

The author discusses the indications and limitations of radiology in the diagnosis of disease In order that radiology may be a reliable diagnostic aid, it is essential to have a standard of minimum requirements for the roentgenologist and roentgenography The roentgenogram should be so made that the utmost of detail and contrast is obtained Having procured such a roentgenogram it is necessary that it be interpreted in terms of pathology by one who has been properly trained in this work.

The radiologist should possess a working knowledge of applied anatomy, pathology, and physiology, together with a general knowledge of medicine and surgery, besides his specialized knowledge of the science of radiology He should have the co-operation of the clinician and pathologist so that he may have the opportunity for studying and

following up the cases after they have passed through his hands Confirmation of diagnosis creates self-confidence and increases the diagnostic ability of the radiologist In like manner, attendance in the operating room and postmortem room will prove valuable aids in the study of disease The radiologist should not be considered an intruder by the clinician, but these two practitioners of medicine should meet and discuss the data obtained

Radiology has been extremely valuable in giving us a truer knowledge about "practical normals" as met with in the every-day practice of medicine, in contradistinction to the "theoretical normals" of the dissecting room The author suggests the inclusion of such a course of X-ray demonstrations of the normal human anatomy from the living in the curriculum for the students in the various medical schools and colleges Our idea of "habitus" resulted from the X-ray examination of large numbers of healthy persons of different body builds Thus the normal variations in the size, shape, and position of the abdominal and thoracic viscera were noted and consequently fewer cases of ptosis of the colon and stomach have been diagnosed In this manner, radiologists have recognized the normal variations in "practical normal" chests

The author discusses the value of radiology in pathologic conditions of the various organs and systems Next to laparotomy, radiologic examination affords the most accurate information as to the presence or absence of diseases of the stomach or intestines He especially emphasizes the value of fluoroscopy in gastro-intestinal work, for indirect and direct signs can best be studied on the screen In gastro-intestinal work the value of radiography lies not in demonstrating the alterations that cannot be seen on the screen but in corroborating the fluoroscopic observations and giving time to the roentgenologist to come to a well-reasoned conclusion

J N ANE, M D

X-ray Therapy Its Principles and Practice, with Special Reference to Deep Ther-

lesions, right heart hypertrophy and failure, generalized cardiac enlargement, congenital heart disease, pericardial effusion, adhesive pericarditis), and pathologic changes in the aorta

W W WATKINS, M D

Outline of Roentgen Diagnosis (ninth paper) Leo G Rigler Journal-Lancet, Aug 1, 1931, LI, 478, 479

This paper deals with the following. The mediastinum (including normal appearance, mediastinitis, mediastinal effusions, mediastinal abscess, substernal thyroid, dilated large veins of the neck, thymus gland, dilated esophagus, paravertebral abscess, glandular enlargements, tumors) and the diaphragms

W W WATKINS, M D

Outline of Roentgen Diagnosis (tenth paper) Leo G Rigler Journal-Lancet, Sept 1, 1931, LI, 547-550

This paper continues the study of the diaphragms. The pleura is then taken up under the headings of general considerations, pleural thickening, pleural effusion, pneumothorax, hydropneumothorax, tumors. The next division includes the lungs, trachea, bronchi, under the subheads of value of X-ray examination, technical consideration, and methods, normal appearance

W W WATKINS, M D

X-Ray in Diagnosis of Thoracic Pathology Hermon Harrison Cole Illinois Med Jour, September, 1931, LX, 260-262

What should a clinical diagnostician expect of the radiologist in the thoracic field? What has the radiologist a right to expect in return? If both are to make the diagnosis, then the facts of the history, physical findings, and laboratory findings should be in the hands of both men

The radiologist, purely on his own, can interpret light and shadow in terms of relative tissue density and note unusual locations. It

is unfair to him and often dangerous to his reputation to ask him to do more. To refuse a diagnosis by radiography alone takes more courage than shrewd guessing.

Differences between anthracosis, silicosis, bronchopneumonia, carcinoma, fibroid tuberculosis, and syphilis are not clear enough at times for certain X-ray identification. The radiologist has a right to history, blood examination, sputum, and other pathologic reports and physical findings.

The author insists that the radiologist read the plate in terms of pathologic densities without reference to final diagnosis. This last is the province of both working together, or of the clinician alone.

He believes that all chest plates should be made with a minimum of exposure and at two meters distance. Stereoscopic plates should be the rule. We have not learned to use lateral and oblique views as often or as intelligently as we should.

CHARLES H DEWITT, M D

ROENTGEN RAY (INDUSTRIAL APPLICATION)

Radiographic Inspection of Metals Herbert R Isenburger Mech Engineering, October, 1931, LIII, 1-8

Radiographic examination is one of the most reliable methods of non-destructive routine testing of the structure of metals. In this work roentgenograms made by means of a penetrating radiation of X-rays are known as "exographs" as distinguished from "radiographs" made by means of gamma-rays obtained from radium or its emanation.

The author believes that X-rays should be employed on steel castings and forgings having a thickness of three inches and less, and that gamma-rays should be used for examination of heavier material. More detail, better contrast, and a shorter exposure time result from the use of X-rays, therefore this form of radiation should be used whenever possible.

Radiography is of great value in foundry

and Joints (normal characteristics as to growth and normal variations), Traumatic Conditions of Bones and Joints—(1) Fractures, (2) Information gained from X-ray examination in cases of bone injury, (3) Characteristics of various fractures, (4) Non-union, (5) Operative findings, (6) Infected fractures, (7) Periosteal tear and traumatic periostitis, dislocations

W W WATKINS, M D

Outline of Diagnosis (third paper) Leo G Rigler Journal-Lancet, March 15, 1931, LI, 204-208.

This paper covers the following Infectious Processes of Bones, as acute, chronic, and secondary osteomyelitis, acquired syphilis, tuberculous osteomyelitis, and miscellaneous conditions, Bone Tumors, under the headings of general considerations, benign and malignant tumors (primary and secondary), Hodgkin's disease, and Paget's disease. These are correlated with the classification of the American College of Surgeons

W W WATKINS, M D

Outline of Roentgen Diagnosis (fourth paper) Leo G Rigler Journal-Lancet, April 1, 1931, LI, 233-235

This article covers the following Diseases of Joints, under the subdivisions of "Normal appearance," "Points to be noted in the study of joint lesions," "Classification and terminology," "Findings in joint lesions" (including acute rheumatic fever, acute arthritis, chronic arthritis resulting from the foregoing, chronic arthritis of non-specific etiology, gout, osteochondritis dessicans, osteochondromatosis, Charcot joint, tuberculosis of joints)

W W WATKINS, M D

Outline of Roentgen Diagnosis (fifth paper) Leo G Rigler Journal-Lancet, May 1, 1931, LI, 294-296

This article continues the consideration of joint diseases under the heading of Diseases about the Joints in Children, including rickets, scurvy, congenital syphilis, and differential diagnosis. Other conditions included are achondroplasia, fragilitas ossium, Mongolian idiocy, cretinism and myxedema, osteomalacia, osteoporosis, osteochondritis juvenilis deformans, Osgood-Schlatter's disease, Köhler's disease, Freiberg-Kohler's disease, and Kienbock's disease

W W WATKINS, M D

Outline of Roentgen Diagnosis (sixth paper) Leo G Rigler Journal-Lancet, May 15, 1931, LI, 320-322

This paper is devoted to Diseases of the Spine, and covers anomalies and deformities, traumatic conditions, infectious diseases, tumors, and iodized oil injections into the spinal canal

W W WATKINS, M D

Outline of Roentgen Diagnosis (seventh paper) Leo G Rigler Journal-Lancet, June 15, 1931, LI, 386-389

This paper includes Normal Anatomy (vascular grooves, sutures, basal structures, convolutional markings), Fractures, Diseases of the Skull, Intra-cranial Conditions (with ventriculography and encephalography), the Sella Turcica, the Mastoids, etc

W W WATKINS, M D

Outline of Roentgen Diagnosis (eighth paper) Leo G Rigler Journal-Lancet, July 1, 1931, LI, 417-420

This paper considers the thorax. It takes up the heart and aorta under methods of examination, the normal heart and aorta, technical points, pathologic changes in the heart and pericardium (including mitral regurgitation, mitral stenosis, double mitral, aortic or hypertensive type, combined mitral and aortic valvular disease, tricuspid and pulmonic

lesions, right heart hypertrophy and failure, generalized cardiac enlargement, congenital heart disease, pericardial effusion, adhesive pericarditis), and pathologic changes in the aorta

W W WATKINS, M D

Outline of Roentgen Diagnosis (ninth paper) Leo G Rigler Journal-Lancet, Aug 1, 1931, LI, 478, 479

This paper deals with the following. The mediastinum (including normal appearance, mediastinitis, mediastinal effusions, mediastinal abscess, substernal thyroid, dilated large veins of the neck, thymus gland, dilated esophagus, paravertebral abscess, glandular enlargements, tumors) and the diaphragms

W W WATKINS, M D

Outline of Roentgen Diagnosis (tenth paper) Leo G Rigler Journal-Lancet, Sept 1, 1931, LI, 547-550

This paper continues the study of the diaphragms. The pleura is then taken up under the headings of general considerations, pleural thickening, pleural effusion, pneumothorax, hydropneumothorax, tumors. The next division includes the lungs, trachea, bronchi, under the subheads of value of X-ray examination, technical consideration, and methods, normal appearance

W W WATKINS, M D

X-Ray in Diagnosis of Thoracic Pathology Hermon Harrison Cole Illinois Med Jour, September, 1931, LX, 260-262

What should a clinical diagnostician expect of the radiologist in the thoracic field? What has the radiologist a right to expect in return? If both are to make the diagnosis, then the facts of the history, physical findings, and laboratory findings should be in the hands of both men

The radiologist, purely on his own, can interpret light and shadow in terms of relative tissue density and note unusual locations. It

is unfair to him and often dangerous to his reputation to ask him to do more. To refuse a diagnosis by radiography alone takes more courage than shrewd guessing.

Differences between anthracosis, silicosis, bronchopneumonia, carcinoma, fibroid tuberculosis, and syphilis are not clear enough at times for certain X-ray identification. The radiologist has a right to history, blood examination, sputum, and other pathologic reports and physical findings.

The author insists that the radiologist read the plate in terms of pathologic densities without reference to final diagnosis. This last is the province of both working together, or of the clinician alone.

He believes that all chest plates should be made with a minimum of exposure and at two meters distance. Stereoscopic plates should be the rule. We have not learned to use lateral and oblique views as often or as intelligently as we should.

CHARLES H DEWITT, M D

ROENTGEN RAY (INDUSTRIAL APPLICATION)

Radiographic Inspection of Metals Herbert R Isenburger Mech Engineering, October, 1931, LIII, 1-8

Radiographic examination is one of the most reliable methods of non-destructive routine testing of the structure of metals. In this work roentgenograms made by means of a penetrating radiation of X-rays are known as "exographs" as distinguished from "radiographs" made by means of gamma-rays obtained from radium or its emanation.

The author believes that X-rays should be employed on steel castings and forgings having a thickness of three inches and less, and that gamma-rays should be used for examination of heavier material. More detail, better contrast, and a shorter exposure time result from the use of X-rays, therefore this form of radiation should be used whenever possible. Radiography is of great value in foundry

and welding practice, as in many cases the possible failure of a casting or forging would cause damage far in excess of the cost of the examination. It has been demonstrated that the undesirable internal conditions in castings fall into relatively few classes, all of which are traceable to definite and simple causes, which can be eliminated by proper foundry practice. It likewise has been shown that when defects have been corrected by proper changes in foundry methods, they tend to stay corrected. Among the undesirable conditions in steel castings mentioned by the author are the following: gas, slag and sand pockets or inclusions, shrinkage cavities or cracks, spongy metal, hot tears, and rupture developed during pressure test.

It is suggested in welding practice that all work should be correlated with the X-ray evidence. Sample welds should be made in scrap pieces of the kind of plate to be used in construction and these should be X-rayed. Production should be delayed until the test films are perfect and the correct procedure determined.

J N ANE, MD

pearances, (2) Those with pronounced dilatation of the ventricles and of the subarachnoid spaces, (3) Those with appearances that point to some pathological change different from that in Group 2.

In 8 patients (47 per cent), the encephalographic appearances were normal.

In Group 2 there were 4 cases (24 per cent). Air persisted in this group for as long as 216 hours and apparently depended on the degree of dilatation of the ventricles.

The third group, comprised of 5 cases (29 per cent), either showed no evidence of the ventricles, or else they were distorted and asymmetrical both in size and location. In addition, patients with pronounced leptomeningeal adhesions were included in this group. The diagnosis of the adhesions was based on the absence of sulci markings.

Notkin concluded, in part, that the persistence of air within the cranium seems to correlate more with the dilatation of the ventricles and of the subarachnoid spaces than with the amount of air injected, and also that subarachnoid dilatations may rarely be seen in roentgenograms taken before the injection of air.

CORNELIUS G DYKE, MD

THE SKULL (DIAGNOSIS)

Encephalographic Studies in Cryptogenic Epilepsy J Notkin Archiv Neurol and Psychiatry, July, 1931, XXVI, 115-130

The author's apparent purpose in making this study was to confirm or reject the statements of Fay and others who say that there is a characteristic encephalographic picture in cryptogenic epilepsy. Fay states "There has been noted a characteristic picture obtained by roentgenograms in those patients showing convulsive state a definite change can be demonstrated in the fluid pathways by this method."

Notkin performed encephalography on 17 epileptic women between the ages of 18 and 49, of whom 14 were definitely deteriorated mentally. The results of encephalography were classified in three groups:

(1) Those patients presenting normal ap-

THE SPINE (DIAGNOSIS)

Compression Fracture of the Fourth Lumbar Vertebra of a Calf Tom Hare Jour Path and Bacteriol, July, 1931, XXXIV, 437, 438

A case is reported of a fractured vertebra of a young calf, which appears to be comparable with fracture of the human spine. Careful postmortem studies fail to support the notion, originally advanced by Kümmell, that the lesion is the delayed collapse of an injured vertebral body.

E C VOGT, MD

A Study of Back Complaints in 1,000 Patients Clarence B Francisco Med Bull

Veterans' Administration, September, 1931,
VII, 808-815

Following his first analysis, four years previously, of 1,000 cases with back complaints, the author has re-examined and treated many of these cases for their back conditions. About 75 per cent of thirty-six cases of tuberculosis of the spine died during this four-year period. It was also observed from the roentgenograms that hypertrophic changes around the vertebral joints and calcification of ligaments tended to increase very slowly, if at all.

The outstanding observation, in the author's opinion, is that the cause of spinal disability is, with a few exceptions, located in the lower spine or its attachments to the pelvis. Of the 1,000 cases, fifteen were vertebral fractures, and in those cases in which the cord escaped injury, the results were not painful or the backs weak. The disability complained of was stiffness of the back and areas of anesthesia irregularly distributed over the legs.

Thirty-five cases of developmental lateral and posterior curvatures and thirty-eight cases of residuals of spinal meningitis were observed. One hundred twenty-eight cases were diagnosed arthritis of the spine. The forty-four acute cases showed no evidence of bone or joint changes on roentgenograms and became free from symptoms by removal of foci of infection or by medical treatment. Most of the cases in the arthritic group were infectious in origin. While a small percentage was known to have syphilis, it was observed that anti-syphilitic treatment was of negative or doubtful value when given.

One hundred and twenty-six cases were considered as sacro-iliac joint conditions, and in eight cases of this group partial or definite obliteration of the joint was shown by X-ray. It was noted also that as the degree of obliteration of the joint increased, the pain experienced by the patient decreased. Ordinary sacro-iliac supports afforded definite relief of symptoms in the majority of cases, but a small number seemed to resist all forms of treatment.

There were three cases in which the coccyx had been removed by operation, with indifferent results. None of them had been entirely

relieved, and two had not been improved. Two hundred one cases showed on roentgenograms evidences of congenital anomalies consisting of the following: Sacralization of the fifth lumbar transverse process, elongated fifth lumbar transverse process, spina bifida occulta, six lumbar vertebrae, abnormal angulation of articular facets.

J N ANÉ, M D

THE THYROID (THERAPY)

Serious Thyrotoxicosis in a Basedow Case Treated with Intravenous Injections of Sodium Fluoride Leon Goldemberg and J Horacio Maggi Prensa Méd Argentina, July 10, 1931, XVIII, 169, 170

Goldemberg was the first to introduce the use of fluorides orally or intravenously in cases of hyperthyroidism, or Basedow's disease. He uses sodium and ammonium fluoride orally and sodium fluoride intravenously. He and Maggi present here a case, which in spite of anything done, including one treatment with radiotherapy, continued getting worse. After the second intravenous injection of sodium fluoride, the symptoms gradually subsided until the patient reached normalcy.

The authors' method consists of giving an initial dose of 3 cc and increasing it 1 cc daily until the patient feels better and then decreasing the dose according to the results.

N G GONZALEZ, M D

Congenital Myxedema Radiologic and Clinical Observations B Lunardi L'Ateneo Parmense, May-June, 1931, III, 169-176

The author describes a case, not entirely typical, of myxedema, in a boy 15 years of age, which was studied radiologically and which presented numerous interesting diagnostic questions. To which of the various forms of osteodystrophy was it to be ascribed?

There were lacking the special characters of acromegalia (for example, micromyelia), like-

wise, the signs of multiple fracture and osseous deformity which might suggest an imperfect belated osteogenesis, the special manifestations of Ollier's disease, as well as those of dyscondroplasia, properly so-called, were absent. Nor did rickets come directly into question, although certain streaks of thickening in the metaphysis of the femur, radius, and tibia suggested a rachitic form. Likewise, the alterations of the distal extremities of the ulna and radius were indicative of a rachitic connection. These, however, were not the predominant signs. The character of the epiphyses observed in the radiogram of one of the coxo-femoral articulations suggested a youthful dystrophy of the epiphyses, but, on the other hand, there were absent numerous characteristics of this form of epiphysitis, principally the crushing of the nucleus and its fragmentation in island-like masses.

The picture is undoubtedly that of a hypothyroidism, which has produced or determined retardation of the nuclei of ossification. Lack of proper nourishment may have influenced the course of the disease, but how is a greater involvement of one bone than another to be explained, as seen in the tibia, in which the nucleus of the anterior tuberosity is entirely lacking, while that of the superior is normal?

Solution of the problem, the author concludes, lies in the assumption of a simultaneous development of myxedema and rickets, in the same manner that we find the former disease associated with mongolism. This fact is of interest both to the upholders of the theory of endocrine disturbance in the etiology of rickets and to those who invoke alterations of the thyroid as well as to those who regard the disease as a pluriglandular disturbance.

W W WHITELOCK, Ph D

THE TONSILS

The Radiologic Treatment of Malignant Tumors of the Tonsils E Berven Strah-Tenthalerapie, Sept. 12, 1931, XLII, 113-135

The author divided his cases of malignant neoplasms of the tonsil into four groups

Carcinoma, lympho-epithelioma, sarcoma, and mixed tumors. He analyzes in this paper 42 patients with carcinoma of the tonsil observed for from three to twelve years, and 8 cases of carcinoma treated in 1930, 4 cases of lympho-epithelioma, 35 cases of sarcoma, and 5 cases of malignant mixed tumors. The latter were also observed for from three to fifteen years. In all patients free of symptoms for more than three years the diagnosis was verified by biopsy.

From 1919 to 1927, 42 carcinoma cases were treated. Of these, 33 were ulcerated, 6 were not ulcerated, and 3 presented papillary growth. They all metastasized early. From 1919 to 1924, they were treated mostly by X-rays from the outside and radium screens placed on the tumor itself on the inside. Of 28 cases treated in this manner, not a single permanent cure could be obtained and they were free of symptoms for less than three years. It is mentioned that Coutard is the only one obtaining good results with roentgen rays in this type of patient.

Beginning in 1924, a new treatment technic was used. Radium was applied over three or four fields, one over the neck on the side of the tumor, one over the opposite side, one over the posterior neck, and one over the cheek. Six tubes 11×25 mm, 500 mg-hr each, filtered through 0.35 mm Au + 0.3 mm Pt = 1.1 mm Pb, were placed over a circular area about 5 cm in diameter. The applicator brought the total filtration up to an equivalent of 5 mm of lead. The surrounding tissue was protected by 6 cm of lead. The distance between applicator and skin amounted to 6 centimeters. The depth doses with the applicator were very satisfactory, for instance, about 30 per cent of the surface intensity reached the tonsil from the area on the same side.

The physicist of the institute suggested a new unit to express the dose, the Curie intensity, which is defined as follows. The unit for the gamma radiation intensity is that intensity present at 1 cm distance from a radium applicator containing 1 gram radium element in equilibrium with its products of decomposition and where the source of radiation is filtered in all directions by 0.5 mm

only. The dimensions must be so small that the source of radiation can be considered a point.

With the applicator described by the author, about 30 gram-hours can be applied as total dose on the skin at the same side on which the tumor is located. Through the opposite side 20 gram-hours may be given, about 20 gram-hours through the neck field, and about 10 gram-hours over the cheek area. The daily dose usually does not exceed 6 gram-hours. This means that the total irradiation takes from thirteen to fourteen days. It is sometimes advisable to arrange for intervals in order to avoid systemic reactions. The patient must be carefully observed, of course, during this course of treatment.

If an area receives a total dose of 40 gram-hours applied during six or seven days with intervals of one or two days, giving daily six hours, the skin reaction corresponds to the radio-epidermitis of the French authors. The ulcerating area in the center of the treated field is about 3×3 centimeters. This reaction begins about the middle of the fourth week and is usually healed at the end of the seventh week. With a dose of 30 gram-hours one obtains only reddening and desquamation of the skin without complete ulceration, while after 20 gram-hours there is only an erythema. Incomplete and temporary epilation occurs following 20 gram-hours but becomes complete after 40 gram-hours. The reaction in the tumor corresponds to the epidermitis described by Coutard. It is necessary to watch these reactions very carefully as well as the reduction of the size of the tumor. A second treatment should be given only if there is no further reduction and this will be about four to six weeks after the first series.

In order to take care of the remaining tumor tissue one might continue radium therapy as carried out in the first series or apply radium tubes to the surface, implant seeds into the tumor, or remove it by the endotherm knife.

If surface application to the tumor is decided upon, four radium tubes, about 20 mm long, containing 25 mg radium element filtered through gold and platinum equivalent to 11 mm of lead, are used. The dose varies

from 450 mg -hrs according to the individual requirements. Implantation is carried out by means of radium needles containing 10 mg radium element, having a length of 15 mm, a diameter of 2.2 mm and combined gold and platinum filtration equivalent to 0.9 mm of lead. After application of cocaine the needles are inserted into the remaining tumor mass. The injection of a local anesthetic is avoided if possible. In some cases the endotherm knife was also used. The results obtained were as follows: 28 cases were treated from 1919 to 1924. Sixteen, or 57.1 per cent, were not improved, 5, or 17.9 per cent, were improved, one of these over two years, 7, or 25 per cent, were free of symptoms for from two to seventeen months and died from recurrence. Fourteen cases of carcinoma were treated with the new technic from 1923 to 1927. Four, or 28.6 per cent, did not show any improvement, 4, or 28.6 per cent, were improved, one case living nearly four years, 2, or 14 per cent, were free of symptoms thirteen months and twenty-seven months, respectively, 4, or 28.6 per cent, were free of symptoms for three, four, four and one-half, and five and three-quarters years, respectively. Four cases of lympho-epithelioma were treated during the same period. One was free of symptoms for six months and died from recurrence, 3 are living three, four, and five years, respectively, since the treatment. The lympho-epithelioma, much more sensitive than the carcinoma, was treated with the technic used for sarcoma which will be outlined later. Analysis of the statistics shows the enormous influence of the stage of the disease, while, for instance, 50 per cent of the cases belonging to Stages 1 and 2 remained free of symptoms for three years, there was not one case of primary cure in the group belonging to the third stage.

Thirty-five cases of sarcoma were seen. Among these, 29 tumors were not necrotic, 6 were necrotic (it appeared that the latter was the more malignant type). It occurred mostly during the age-period from twenty to thirty years. A combination of roentgen rays from the outside and radium contact application was applied. In the earlier years the author used moderate potential and aluminum filter,

while lately 160 to 170 KV, 0.5 mm Cu + 1 mm Al, corresponding to a half value layer of 0.85 mm Cu, were employed. In a field of 10×10 , 700 r corresponded to the H E D. Sometimes a different filter combination giving a half value layer of 1.42 mm Cu was used. The H E D corresponded to about 100 r, F S D 40 cm, 10×15 sq cm field of entry. Small doses of from 1/6 to $\frac{1}{4}$ H E D are given first. Quite often the tumor reduces definitely after the first few treatments. The dose is increased only if no further reduction can be obtained by these small doses. One must carefully watch the tissue surrounding the tumor in order to avoid excessive inflammation followed by edema. The patients usually receive during two weeks a total of from 1 to $1\frac{1}{2}$ H E D over one or both sides of the neck.

After the tumor has reduced enough in size, radium application is carried out. As a rule four radium tubes are used of 20 mm length, containing 25 mg radium element. The gold-platinum filter corresponds to 1 mm of lead. Doses of from 250 to 1,700 mg-hrs are applied to the tumor surface. Of 35 cases treated from 1916 to 1927, 6, or 17.2 per cent, were not improved, 4, or 11.4 per cent, were improved from one and one-half to four months, 10, or 28.6 per cent, were free of symptoms but died within three years, 15, or 42.8 per cent, were well for from three to twelve years. The influence of the stage of the disease on the final result is also quite evident in these statistics. The author emphasizes that the surgical removal of the tonsillar sarcoma is rather risky. In four out of seven cases local recurrence developed three weeks after tonsillectomy and in two other cases metastases appeared. Biopsies in this type of tumor should be taken, therefore, with great caution.

Five cases with mixed neoplasms were treated with the same technic as the carcinoma. After the tumor had reduced in size the remaining mass was usually removed by the endotherm knife. Two cases were very radioresistant. Three reduced in size following irradiation and could then be removed. Of these three patients, one is alive four

years, one four and three-fourths years, and one five years, respectively, after the treatment.

In conclusion, the author discusses the difficulties in the differential diagnosis between syphilis and malignant tumor of the tonsil. Very often there may be a combination of both. It is dangerous, however, to wait with the proper treatment in case of a malignancy. One must also remember that anti-syphilitic treatment can reduce the necrosis and the size of a malignant tumor, particularly in cases which have syphilis in addition to the malignancy. The prognosis in these cases seems to be rather poor.

ERNST A. POHLE, M.D., Ph.D.

TUBERCULOSIS (DIAGNOSIS)

Skiagraphy in the Diagnosis of Pulmonary Tuberculosis M. Kesava Pai. Antiseptic, July, 1931, XXVIII, 506-509

In the diagnosis of tuberculous hilus disease, circumscribed pneumothoraces, pleural effusions, and occluded cavities, the X-ray has great advantage over our present-day methods of physical diagnosis. Roentgenography is likewise of value as a means of keeping permanent records of chest conditions at different times in the course of treatment.

In the study of roentgenograms of chest diseases it is absolutely essential that the appearance of the normal chest be known and recognized. Pathologic research has proved that tuberculous pulmonary lesions—healed, healing, or active—are present in the vast majority of adults, especially in the region of the hilus. Therefore, a certain degree of "hilus shadow" can be considered normal for all practical purposes. It should be remembered that the hilus shadow is made up by a number of structures, including bronchi, lymphatic glands, and blood vessels. Fluoroscopic examination reveals information regarding the movements of the diaphragms and chest wall, the lighting up of the apices, and the relative translucency of the lungs during inspiration and expiration.

In the pathologic chest a ground glass appearance on the roentgenogram indicates the

presence of thickened pleura or a very thin layer of effusion. The author advises that in the application of artificial pneumothorax treatment a skiagram of every patient be taken and examined before applying treatment. Pneumothorax collapse is a dangerous procedure to be adopted when there is active disease in the opposite lung, for it is a common experience to find deep disease on the collateral side, as seen on the roentgenogram, when it was not suspected by physical examination. The author briefly discusses the roentgenographic diagnosis of various pulmonary conditions and includes reproductions of roentgenograms.

J N ANE, M D

The author claims 100 per cent cure in all his nephrectomies

N G GONZALEZ, M D

The Co-existence of Pulmonary Tuberculosis and Other Intrathoracic Lesions
Alexander Josewich Med Bull Veterans' Administration, September, 1931, VII, 803-807

The author believes that the possibility of the association of tuberculous and non-tuberculous intrathoracic lesions has not received due consideration because of the stress that has been put on the differential diagnosis of these conditions by medical literature in general.

Bronchitis, either of the acute or chronic variety, is frequently found associated with tuberculosis. The presence of prolonged bronchitis should always lead the clinician to suspect the association of frank or marked tuberculosis. In some cases of advanced tuberculosis with associated chronic bronchitis, the diagnosis of bronchitis alone is made, on account of constant failure to find the tubercle bacilli. In attempting to come to a true conclusion in such problems, it is to be remembered that although the roentgen examination shows no dependable evidence of bronchitis the hidden areas of tuberculosis, which may not be detected by physical examination, are at times easily revealed by the roentgenologic examination. In the study of these cases the author emphasizes the necessity of employing the diagnostic triad of time, perseverance, and common sense.

Although subacute and chronic interstitial pneumonitis were accurately described decades ago, these conditions have received especial attention during and subsequent to the war. Confusion resulted in many cases and non-tuberculous lesions were considered tuberculous. Of late, however, the detection of these conditions has served to definitely rule out the existence of tuberculosis in interstitial pneumonitis. While in a series of interstitial pneumonitis the author has found less than 5 per cent associated with tuberculosis, he believes that the possibility of the co-existence of these lesions should be kept in mind.

Diagnosis and Treatment of Renal Tuberculosis Mario Donati Revista Med Cubana, October, 1931, XLII, 1202-1218

According to Lasio, in 10 per cent of cases of pulmonary tuberculosis, urogenital tuberculosis is present, and in from 40 to 80 per cent, renal tuberculosis accompanies a tuberculous lesion elsewhere. Since renal tuberculosis seldom manifests itself save in advanced stages, the author advises the examination of urine for the Koch's organism whenever it is known that a tuberculous infection exists elsewhere. He classifies the lesions as (1) Caseous ulcerative type, (2) nodular type—either circumscribed or disseminated, and (3) fibrous type.

The majority of cases of renal tuberculosis occurs between the ages of twenty and forty years. The infection is usually unilateral for a long time. At an early stage, there is a specific secondary inflammation, either of the ureter, of the bladder, or both. The symptoms are usually as follows: Frequency, pain (either unilateral or bilateral), painless bloody urination, symptoms pointing toward pyelonephritis or pyelonephrosis, and marked acidity of the urine. Cystoscopies and pyelograms are of great help in the diagnosis.

The treatment of choice in unilateral or even in bilateral cases in which the function of the better kidney is good is nephrectomy. Medical treatment does not yield good results.

while lately 160 to 170 KV, 0.5 mm Cu + 1 mm Al, corresponding to a half value layer of 0.85 mm Cu, were employed. In a field of 10×10 , 700 r corresponded to the HED. Sometimes a different filter combination giving a half value layer of 1.42 mm Cu was used. The HED corresponded to about 100 r, FSD 40 cm, 10×15 sq cm field of entry. Small doses of from $\frac{1}{6}$ to $\frac{1}{4}$ HED are given first. Quite often the tumor reduces definitely after the first few treatments. The dose is increased only if no further reduction can be obtained by these small doses. One must carefully watch the tissue surrounding the tumor in order to avoid excessive inflammation followed by edema. The patients usually receive during two weeks a total of from 1 to $1\frac{1}{2}$ HED over one or both sides of the neck.

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ERNST A. POHLE, M.D., Ph.D.

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to the proteins of their own bronchial secretions. Extensive investigation, however, has failed to produce satisfactory evidence of the existence of a sensitizing protein of the tubercle.

The author reports twenty additional cases of pulmonary tuberculosis associated with bronchial asthma, presenting, roentgenologically, evidences of apical cavitation. Two cases were suggestive of bronchiectasis as an additional complication, based on the X-ray evidence of lower lobe dilatation of the bronchi. Sputum positive for the tubercle bacillus was demonstrated in every case. Cutaneous and intra-cutaneous protein tests, which were made to identify the suspected bacterial allergy, were of little diagnostic value. Following the adoption of the subcutaneous injection method, the reactions obtained were strongly suggestive for bacterial allergic response. This also was abandoned following the production of a pulmonary hemorrhage in one case, with a marked extension of the tuberculous lesion and rupture of the cavity wall. Artificial pneumothorax was considered necessary in this case and when satisfactory compression of the apical cavity occurred, all asthmatic symptoms ceased. This patient has been under constant observation for four years following the pneumothorax and at no time has demonstrated a return of asthmatic symptoms. Although this is the only case in the author's series treated by artificial pneumothorax, he considers the question of the advisability of the employment of artificial pneumothorax in the treatment of severe asthma, either associated with unilateral cavitation of tuberculous etiology, or in severe asthmatic cases of non-tuberculous background in which there is evidence of retained secretions.

J N ANÉ, MD

TUMORS (DIAGNOSIS)

Roentgen Diagnosis of Infected, Intraperitoneal Hematoma Gosta Gräberger Acta Radiologica, 1931, XII, No 66, 15, IV, 152-156

In Upsala, roentgen examination of acute and subacute abdominal cases is very commonly employed. The patients are screened, and the movements of the diaphragms and the appearance of the lungs are carefully observed. Plain films of the abdomen are studied for free gas in the abdominal cavity, distention of the small bowel with gas, the outline of the psoas muscle, and the layers of fat in the flank. A barium enema usually concludes the examination.

Laurell has already reported on the appearance of the lateral abdominal wall in these cases. Normally there are visible in the flank four layers of fat: (1) Subcutaneous, (2) and (3) intermuscular, and (4) subperitoneal. When abdominal or retroperitoneal processes reach the lateral abdominal wall, the hyperemia and edema of the subperitoneal fat cause so much absorption of the X-rays that this layer of fat either becomes much less plainly visible or can not be seen at all.

The author reports the course of a case of acute appendicitis in a man 47 years old. Operation was done twelve hours after the onset of the illness and a gangrenous appendix removed. There was considerable turbid fluid about the cecum, but no bacteria were found in it at microscopic examination.

The patient did not do well, and five days after the operation came to roentgen examination with a diagnosis of ileus. Both diaphragms moved freely. Two dilated loops of small intestine were seen in the lower abdomen. A homogeneous shadow in the right flank displaced the cecum and ascending colon medially. The subperitoneal layer of fat was clearly visible. A diagnosis of intraperitoneal hematoma was made.

The patient became worse and four days later was re-examined under a clinical diagnosis of peritonitis. At this time the right diaphragm showed a marked lagging. The homogeneous shadow in the right flank was unchanged but, from the crest of the ilium to the liver, the subperitoneal layer of fat was invisible. A diagnosis of infected intraperitoneal hematoma was made.

Immediate operation was done. About two liters of coagulated blood without grossly visi-

In like manner, carcinoma of the lung or foreign bodies in the respiratory tract may be found associated with active tuberculosis. While the fibrotic changes which take place about a foreign body should not be considered tuberculous, the possibility of the association should be remembered. Aneurysms, mediastinal tumors, and paravertebral abscesses are other conditions found associated with tuberculous involvement. In the author's opinion, the most evident condition should not be allowed to occupy the entire field in such a manner that associated tuberculous lesions are overlooked.

J N AKE M D

A Case of Tuberculosis of the Third Portion of the Duodenum, Secondary to Tuberculosis of the Adjacent Retroperitoneal Lymphatic Glands Rodolfo Viviani Riv di Patolog e Clin della Tuberculosis, July 31, 1931, V, 521-537

It is well known that tuberculous ulcers may, although infrequently, be located in the duodenum. As a rule, however, these are secondary to pulmonary tuberculosis, a condition accompanied with great frequency by intestinal ulcerative conditions of the same nature, particularly in those parts which are most generously provided with lymphatic apparatus, in which the disease process in question locates itself with predilection. It is a familiar fact, also, that tuberculosis may appear, although rarely, exclusively in the duodenum.

On the other hand, tuberculosis transmitted to the duodenum directly from the adjacent tuberculous glands represents an exceptional anatomic finding, according to the literature.

In establishing the highly anomalous nature of the case which he reports, the author confines himself mainly to radiologic procedure and findings, together with a few clinical data. The anatomo-pathologic aspects are discussed by another investigator in an article in the same issue.

The author's observations demonstrate two noteworthy facts. First, that the duodenal contents may repeatedly and for a long time invade the biliary channels without causing

appreciable lesions; second, the peritoneal serosa does not always react with the customary violence to the invasion of infectious material but may manifest relative tolerance. It is possible for an acute generalized perforative peritonitis to arise, accompanied by a clinical symptomatology, objective or subjective, relatively attenuated and under pathologic conditions permitting the prolongation of life for a considerable time beyond the limits usually imposed by the process in question.

W W WHITELock, Ph D

TUBERCULOSIS (THERAPY)

The Effect of the Sea Climate on the Red Blood Picture and Tests for the Climatic Reaction on the Sea in Surgical Tuberculosis M Bracher Strahlentherapie, May 20, 1931, XL, 650-657

Children from large cities brought to the sea shore showed a definite increase in hemoglobin, averaging about 10 per cent. Improvement in the blood picture was also seen in patients with surgical tuberculosis. The sedimentation reaction proved to be a valuable guide in prognosis. The mechanism of the climatologic reaction is discussed.

ERNST A POHLE, M D, Ph D

The Asthmogenic Significance of Pulmonary Cavitation in Tuberculosis Associated with Asthma J T Malone Med Bull. Veterans' Administration, September, 1931, VII, 799-802

The author has previously reported a series of ten cases of active pulmonary tuberculosis and associated asthma in which the presence of pulmonary cavitation suggested an etiologic factor of asthmogenic consideration from the standpoint of an existing bacterial sensitization, produced by a focus of mixed infection in retained cavitary secretions. Demonstration of the existence of bacterial allergy was accomplished in these cases by the marked reaction to the injection of a non-sensitized bacterin of mixed bacterial composition employed in small graduated doses. In this regard Eiman believes that 50 per cent of the patients suffering from bronchial asthma are sensitized.

The results published show that the quantity of sugar present is well within the normal limits during the fasting stage, however, the glycohematic curve, after alimentation, shows a peculiar trend in the descending phase, the sugar content diminishing much more slowly than in normal subjects and persisting in noteworthy quantities even two hours after meals

The author is of the opinion that this factor may possibly be of aid in the diagnosis of doubtful cases of malignant tumors and that a normal glycohematic behavior can almost definitely exclude the diagnosis of a neoplastic growth

Comparative experiments for the study of the influence of the nervous systems lead the author to conclude that stimulation of either system shifts the normal glycohematic equilibrium in the same direction. Other factors, however, such as those present in the stimulation of the vagus nerve by pilocarpine, seem to lend credit to the existence of a parasympathetic excitability in the presence of malignant tumors

L MARINELLI

TUMORS (THERAPY)

Shall It Be Radium or Surgery in the Treatment of Uterine Fibroids? H W Hewitt. Jour Michigan St Med Soc, March, 1931, XXX, 129-131

Reduced to a practical basis, the indications and contra-indications for radium and surgery are as follows: radium may be used in intramural tumors not larger than a four months' pregnancy in women at or near the menopause, in patients whose physical condition has been depleted by hemorrhage, and in all patients in whom surgical measures are contraindicated. Myomectomy is indicated in young women in whom child-bearing is a consideration, it being desirable to preserve ovarian function, and in whom other abdominal pathology necessitates a laparotomy. Hysterectomy is indicated in cases in which tumors are large, cause pressure, have degenerated, are subperitoneal or submucous, and in which adneal disease, corpus cancer, or some lesion

of doubtful nature exists. There is no competition between radium and surgery, each has its own field

(Note—X-ray therapy is mentioned at the outset of the article as the third method of treatment, but it is not discussed.)

W W WATKINS, M D

The Influence of Roentgen Irradiation on the Metabolism of the Jensen Sarcoma A Low-Beer and M Reiss Strahlentherapie, Sept 12, 1931, XLII, 157-159

The authors report the results of their investigations dealing with the metabolism of tumor tissue from one to five days following irradiation. They selected the Jensen sarcoma for their experiments. The tumor tissue was implanted under the abdominal skin of rats. As soon as the tumors had reached the size of a hazelnut, which usually occurred twelve days after the implantation, roentgen rays were applied. The exposure was confined to the tumor proper and the remaining part of the body was carefully protected. In view of the superficial location of the tumor, 120 K V, 4 ma, 30 cm F S D, and 4 mm Al were used. The dose applied in one sitting amounted to 650 r. It appeared that the oxidation processes were considerably decreased following the application of this dose. This was shown by the fact that the glucolysis was considerably increased as compared with non-irradiated tumor tissue.

ERNST A POHLE, M D, Ph D

ULTRA-VIOLET LIGHT

The Effect of Ultra-violet Radiation on Sucrase II—The Rôle of Tryptophan and Yeast Gums G Gorbach and K Lerch Biochem. Ztschr., 1931, CCXXXV, 259-266

On dialyzing a yeast autolysate its sucrase activity increases during the first few hours, but, after 30 hours, it decreases very much and shows a continual gradual and steady loss after 48 hours. In the very beginning of the dialysis the dry residue decreases to a small fraction of its original value, and after 48

ble pus were found in the right side of the abdomen, extending upward under the liver. At microscopic examination bacteria were found in the coagulated blood removed from the abdomen. Subsequent recovery was uneventful.

A L HART, M.D.

Malignant Pheochromocytoma of the Adrenals E S J King *Jour Path and Bacteriol*, July, 1931, XXXIV, 447-452

A hitherto undescribed form of pheochromocytoma affecting both adrenals is reported. Two types of cells were present, typical pheochrome cells and anaplastic cells, with all stages of transition between these types. Metastases were numerous to the soft-tissue organs as well as to the bones.

E C VOGT, M.D.

Experimental Tar Tumors in the White Rat A F Watson *Jour Path and Bacteriol*, May, 1931, XXXIV, 301-306

Skin tumors were produced in two male and two female rats by means of the periodic treatment with a gas works coal tar, each application of tar being preceded by a petroleum ether extract of rat tissues.

The tumors appeared from 415 to 551 days after the first application of tar, and in the males were squamous-cell carcinomas. One animal showed extensive metastases. The tumors in the female rats were of slower growth and only one of these showed local extension.

Inoculations of these tumors into normal rats were unsuccessful.

E C VOGT, M.D.

Intra-articular Endothelioma of the Synovial Membrane Julio Diez *La Prensa Médica Argentina* Sept 20, 1931, II, 487-500

The author begins the discussion by calling attention to the fact that there are only seven reported cases of intra-articular endothelioma in the entire medical literature. He attributes

the rarity of the growth to the fact that accurate diagnosis is difficult, even with the aid of the microscope. In Smith's case Ewing classified it as endothelioma and Mallory as fibro-sarcoma with hyperplasia.

The purpose of the article is to bring out some histologic points which facilitate the diagnosis and to point out clinical facts which have been left out in previous reported cases.

The author makes mention of the fact that X-ray films clarify the diagnosis, but it is difficult to differentiate primary articular sarcoma. According to the author, the latter is more diffuse and grows rapidly. The benign growths should give no difficulty in differentiation.

Several photomicrographs are shown at different magnifications. One X-ray film is reproduced giving the shadow of the tumor. In the discussion of the X-ray findings, it is stated that the anteroposterior view in the author's case was entirely normal, while the lateral view showed the growth plainly.

In the line of treatment the author is in favor of high amputation. No mention is made of the use of deep X-ray or radium.

JOSEPH MALDONADO, M.D.

Multiple Teratomas of the Peritoneum W G Barnard *Jour Path and Bacteriol*, May, 1931, XXXIV, 389-391

This is a case report of an ovarian teratoma with many secondary nodules scattered over the peritoneum.

The patient, 40 years of age, died four months after she first noticed an enlargement of the abdomen. How the dissemination took place was not clear, as there was no direct evidence of rupture of the primary growth.

E C VOGT, M.D.

Blood-sugar Regulation and Vegetative Tone in Malignant Tumors Vittorio Romanin. *Minerva Med*, June 9, 1931, XXII, 870-876

This is an experimental study on the sugar content of the blood of cancerous patients.

ily seen when cases of herpes or neuralgia are treated

While no single therapeutic agent can be a panacea, the ultra-violet rays when properly used by one who understands the biologic effects of irradiation, are found to act as a specific cure in some conditions, when used with other forms of therapy, ultra-violet radiation is certainly a valuable aid

J N ANÉ, M D

NOT OTHERWISE CLASSIFIED

Roentgen Findings as Evidence in Medico-legal Cases William A Evans Jour Michigan St Med Soc, May, 1931, XXX, 329-339

Contradictions in medical testimony are often credited to bias, prejudice, or actual dishonesty on the part of the witness, yet conflicts in statements many times are based on honest differences in opinion there are certain moot questions regarding which authorities hold opposing views and there are differences in opinion due to variations in quality and degree of training and experience

In roentgenology, errors of inexperience can be grouped in three classes first, interpretation of normal structures as pathologic or traumatic, such as blood vessel grooves on shafts of long bones or skull bones, irregular calcification of costal cartilages, variation in rib density due to overlying pulmonary shadows, second, interpreting anomalies or variations in structure as disease or injury, such as accessory tarsal scaphoid or prehallux as fracture, non-united astragaloïd tubercle as fracture (true fractures do occur at this point), hamstring sesamoids as avulsed fractures or loose bodies in knee joints, sesamoid at the acetabular margin as fracture of the ilium, occult spina bifida as fracture, rudimentary ribs at the first lumbar as fractured lateral processes, bipartite carpal scaphoid as fracture, third, interpreting pathologic or disease changes as injury or acute trauma The most common mistake in this last group is in interpreting chronic inflammatory changes in the spine as being due to injury, or the de-

formity of Pott's disease as due to trauma Other sources of misinterpretation are the connection of trauma with malignancy, and the relation of trauma and arthritis

The increasing burden being placed on employers for the medical care of their injured help and the resulting compensation will necessitate action on their part to reduce the number of claims or to lessen the awards Comprehensive preliminary examinations will become necessary, which will involve, in addition to careful physical examinations, roentgen studies of the chest and spine

W W WATKINS, M D

Eunuchism of Feminine Type Diabetes Insipidus Thyroid Insufficiency Hypophysis Diencephalic Cachexia Mario Schteingart and Alberto Arnaudo Prensa Méd Argentina, Aug 20, 1931, XVIII, 351-357

The authors present a case of a man 34 years old with this complex syndrome At the age of five, following pneumonia, he grew very rapidly but remained below normal mentally When 16 years of age, he developed polydipsia and polyuria, urinating as much as seven quarts a day His whole physical development was feminine in type, the genital organs atrophied, there was diaphysio-epiphyseal hypertrophy, with osseous transparency, articular hyperextension, myxedematous infiltration, dry, hard hair, acrocyanosis and cold extremities, low metabolic rate, gradual loss of weight, etc A roentgenogram showed a rectangular sella turcica with hypertrophy of the postclinoïd apophysis The patient was under observation for three years and during that time there was a gradual loss of weight, the general condition growing worse

N G GONZALEZ, M D

Psychic Regulating Apparatus Psychic Disturbances (Activity, Emotions, etc) in Mesocephalic and Diencephalic Hypophysial Lesions Armando Camauer Prensa

hours it decreases only slightly. The tryptophan content determined spectrophotometrically follows the same sort of curve. During the first hours of dialysis the activity per unit of dry weight runs parallel to the changes in tryptophan content, and the striking fall in activity after 30 hours is accompanied by a similar drop in tryptophan. The yeast gums, unlike the tryptophan, do not have a region of selective absorption, though the shorter the ultra-violet wave the more strongly it is absorbed. At a wave length of 270 m μ the gums have only 1/630 the absorbing capacity of the tryptophan. The inactivation of the sucrase is independent of changes in the gum content.

CHEMICAL ABSTRACTS

Fluorescent Studies on Pathogenic Fungi in Various Spectral Ultra-violet Lights G H Klovekorn and Otto Gaertner Strahlentherapie, 1931, XLI, 370, 371

The fluorescence of six micro-organisms was studied for the lines 3,660, 3,120, 3,020 and 2,650 Ångströms. While all showed fluorescence with all lines examined, 3,660 Å proved to give the best results. *Mikrosporon audouini* and *Achorion quinckeanum* showed the strongest fluorescence. For the diagnosis of mikrosporia this line is, therefore, most suitable.

ERNST A. POHLE, M.D., Ph.D.

Ultra-violet Radiation V C Sudarsanam Antiseptic, July, 1931, XXVIII, 531-539

The sun was worshipped by the earliest tribes in history and even to-day holds a prominent place in the religious rites of many of the older races. Hippocrates established a health temple to Aesculapius, God of the Sun, Medicine, and Music. The priests, who were also physicians, used the natural agencies of air, light, and water in the cure of diseases and the pursuit of both physical and mental culture. Up to about fifty years ago, the virtues of sun, air, and light were forgotten. The author thus reviews the history of ultra-violet radiation.

of ultra-violet rays

may be divided into reactions of degradation, synthetic reaction, and double decomposition. The absorption phenomenon of the ultra-violet ray may be considered as one of the most important of its physical properties. Ozone absorbs ultra-violet rays very strongly. All glasses that contain metals of high atomic weight absorb most of the rays. "Vita glass," containing a large proportion of quartz, has been used in hospitals because of its property of transmitting most of the ultra-violet rays of sunlight.

In the presence of ultra-violet rays a lighted candle glows a bright blue, liver shows an intense yellowish fluorescence, suprarenals an orange red, and cerebral cortex a yellow. This property is especially valuable in distinguishing pearls. Japanese-cultivated pearls give a yellowish fluorescence, oriental pearls appear bluish, and artificial pearls show no fluorescence.

The theories advanced to explain the mode of action of ultra-violet radiations are as follows: (1) That the autonomic nervous system is directly influenced, (2) that rays penetrating as far as the capillaries of the corium are absorbed by the blood, (3) that some substance formed in the epidermis acts as a hormone. Continued irradiation of the skin produces pigmentation. Certain changes take place in the skin as a result of the absorption of ultra-violet rays. It has been proved that these rays convert the cholesterol in the skin into Vitamin D, which stimulates calcium, iron, and phosphorus absorption.

During general irradiation of the body there occurs dilatation of the surface capillaries, and a comparative disengorgement of internal vessels results. Blood serum and blood corpuscles absorb all rays less than 4,500 Å. There is a slight increase in the red and white cells and in hemoglobin. Also, an increase in the immunizing and bactericidal properties of the blood occurs. Reflex contraction of the involuntary muscles results under irradiation, and this property has been tried in some cases of constipation, with benefit. Loss of appetite is likewise relieved by irradiation through the stimulation of the digestive glands. The analgesic effect of the rays is more pronounced with the carbon arc and can be read-

ily seen when cases of herpes or neuralgia are treated

While no single therapeutic agent can be a panacea, the ultra-violet rays when properly used by one who understands the biologic effects of irradiation, are found to act as a specific cure in some conditions, when used with other forms of therapy, ultra-violet radiation is certainly a valuable aid

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N G GONZALEZ, M D

Psychic Regulating Apparatus Psychic Disturbances (Activity, Emotions, etc) in Mesocephalic and Diencephalus Hypophysial Lesions Armando Camauer Prensa

Méd Argentina, July 30, 1931, XVIII, 249-255

The purpose of this paper is to show that there are areas in the brain which control the psychic part of human beings. The author reviews cases presented by other neurologists which tend to prove that in lesions of the tubero-infundibulo-hypophyseal region there are frequently found disturbances of psychic activity without any alteration of the intellectual and mental part. The disturbances are marked psychic retardation, changes in character and disposition, and a marked oscillation from gay to sad and vice versa. The author believes that we can conclude that there exists in the region of the third ventricle, in the periventricular and mesocephalic constellation a regulatory apparatus of psychic function. He presents the case of a man 65 years old, with a family history of syphilis, who came to him because of heaviness in the leg and psychic disturbances. A radiograph showed the presence of a lesion pressing down on the sella turcica. The Wassermann reaction was ++. The conclusion was syphilis.

N G GONZALEZ, M D

CHEMICAL ABSTRACTS

The Modification of the Permeability of the Cell Membrane by the Combined Effect of X-rays and Photochemical Catalysts
Lydie Tsebrikow Arch Intern Méd Exper., 1930, V, 641-648

The photochemical catalysts, colloidal Fe, colloidal Ag, or colloidal Au, appear to augment the effect of X-rays upon living tissues, both normal and cancerous. The permeability of the cell membrane is increased and the production of photochemical reactions is facilitated. The effect is not produced by trypan blue or trypaflavine.

CHEMICAL ABSTRACTS

An Experimental Study of the Natural Widths of the X-ray Lines in the L-series Spectrum of Uranium John H Williams Phys Rev, 1931, XXXVII, 1431-1442

The half widths at half maximum of the

rocking curves in parallel positions of the double X-ray spectrometer with calcite crystals reflecting in the first order have been investigated as a function of wave length. This function is shown to be linear. The rocking curves of $U\text{ L}_\alpha$ in three different anti-parallel positions of the instrument give a natural width practically independent of the dispersion. The natural widths of $U\text{ L}_\alpha$ and $U\text{ L}_\beta$ show no dependence on voltage. The half widths at half maximum of 12 lines in the $U\text{ L}$ -series spectrum are given. The results are discussed from classical and quantum theory points of view.

CHEMICAL ABSTRACTS.

X-ray Investigation of the Crystals of Copper Formate Dihydrate Mata Prasad and Hirralal M Mapara. Indian Jour Phys ics, 1931, VI, 41-49

The structure of Cu formate dihydrate was studied by the rotating crystal method. The dimensions of the unit cell are (a) 8.952, (b) 6.726, (c) 8.235 Å U, the crystal belongs to the space group C_{2h}^5 , the cell contains four molecules and they are asymmetric, the molecules may lie near the (ac) face and may be connected with each other by water molecules lying in the (bc) face.

CHEMICAL ABSTRACTS

The Action of Radium Emanations on Bacteria, the Filterable Virus of Peripneumonia and Bacteriophage B P Ebert and L H Peretz Zentralbl f Bakteriol Parasitenk u Infektionskr, 1931, 1 Abt, CXXI, 258-267

Trypsin is very resistant to Ra emanations, bacteriophage is equally resistant. Vegetative cells of bacteria and the filterable virus of peripneumonia of cattle are much less resistant, although spores are resistant. This points toward bacteriophage being enzyme-like in nature.

CHEMICAL ABSTRACTS.

X-ray Study of Very Pure Iron O L Roberts Phys Rev, 1930, XXXV, 1426

Carbon-free Fe was prepared from pure $\text{Fe}(\text{NO}_3)_3$. X-ray diffraction patterns show that face-centered cubic structure exists at 921°

CHEMICAL ABSTRACTS

of charge in atoms and favored the interpretation of ψ^* as a probability of occurrence of an electron

CHEMICAL ABSTRACTS

X-ray Analysis of Slate Harold V Anderson and Kenneth G Chesley Am Jour Sci, 1931, XXII, 103-112

The interplanar spacings as obtained by the powder method are given tabularly for slates from seven localities and the principal spacings for minerals which were found to be present in slate. The Al silicate in slate is cyanite (not kaolin or andalusite). Quartz, corundum, cyanite, and mica preponderate

CHEMICAL ABSTRACTS

Effect of Chemical Combination on the X-ray Spectra of Copper E A Owen and T E Williams Proc Royal Soc (London), 1931, A, CXXXII, 282-295

The K_α doublet of Cu in Cu and its oxides and in a number of intermetallic compounds and solid solutions has been investigated. In all cases there was no change found in the wave length of the $K_{\alpha 1}$ line, or in the separation of the lines in the doublet. It is pointed out that whereas these results are probably true for the intermetallic compounds and solid solutions, they do not hold for the oxides of Cu because of the decomposition that takes place when the latter are placed on the target of an X-ray tube. The positions of the K absorption edges of Cu in the same substances together with a number of inorganic compounds of Cu were determined. The edge in Cu and in the cuprous salts corresponds to the wave length 1377.4 X U and was the same as that obtained with the intermetallic compounds and solid solutions. In all the inorganic cupric salts the edge had moved toward the shorter wave lengths. The shift amounted on the average to 11 X U, which corresponds to 71 v. When an electron is removed as in the formation of cupric compounds a re-arrangement of the remaining

Action of Low-speed Electrons on Photographic Emulsions R E Burroughs Rev Sci Instruments, 1931, II, 321-328

Electrons from a heated cathode were accelerated by a potential to an anode containing a slit. The electron beam passing through the slit was focused by a magnetic field on the photographic emulsion being studied. The experiments performed brought out the following facts: (1) No electron impacts were recorded when the electron beam was not distinctly defined by a visible radiation from the residual gas, (2) the lowest voltage recorded in each case was the lowest energy electron that would produce a visible radiation in the residual gas of the electron tube, (3) the lowest potential which would cause the electron to render the photographic plate developable was determined by the composition of the residual gas and its pressure and in no way indicated that it was related to a characteristic of the photographic emulsion.

The conclusion is drawn that the exposure produced on a photographic emulsion is not due to the sensitive grain receiving the electron's energy directly, but is due to the radiations excited by impacts of the electrons with the residual gas.

CHEMICAL ABSTRACTS

Scattering of X-rays in Argon G Herzog Ztschr Physik, 1931, LXIX, 207-234

The variation with scattering angle of the intensity of X-rays scattered in A is investigated photographically. The results agree with theoretic calculations of Waller and Hartree and confirm the atom model assumed by them. Herzog questions the validity of the analysis by which Compton deduced from experiments on X-ray scattering the distribution

electrons takes place, which causes a change in the energy of the electrons in all the orbits, including those of the K group. Thus the energy necessary to eject a K electron is increased, causing the K absorption edge to move to a shorter wave length. If the formation of an intermetallic compound involved two Cu electrons it would be revealed by a shift in the absorption edge. Since there is no shift the Cu atom in intermetallic compounds must be in the cuprous state.

CHEMICAL ABSTRACTS

The Nature of the Radiations Active in the Phenomena of Photosensitization Jean Cuzin Bull soc chim biol, 1930, XII, 1401-1409

Eosin and methylene blue exert a tonic effect upon the isolated rabbit intestine which interferes with the mild effect of radiation. Hematoporphyrin is sensitive to the entire range of the spectrum studied, but is less sensitive in the yellow, green, blue, and ultraviolet.

CHEMICAL ABSTRACTS

Further Investigation of the Magnesia-zircon Series Based on X-ray and Microscopic Examination A L Roussin and J H Chesters Trans Ceram Soc, England, 1931, XXX, 217-224

Ignited mixtures of magnesite and zircon were found to contain at least two additional minerals, occurring in maximum amounts in the 20-80 and 50-50 mixtures by weight. The mineral found in the 20-80 mixture was similar to zircon microscopically, but had a different X-ray pattern.

CHEMICAL ABSTRACTS

Influence of Chemical Binding on the X-ray Absorption Spectrum Richard Swinne Wiss Veroffentlich Siemens-Konzern, 1931, X, No 2, pp 89-94

It is known that the X-ray critical absorption discontinuities of an element sometimes

exhibit varying degrees of fine structure, depending on the chemical combination. The author points out that London's theory of chemical binding predicts for some cases such energy terms as will account for the fine structure, but that these will not be obtained with polar binding or with neutral free atoms. It is also known that rhombic S is an exception to the general rule that the wave length of the absorption discontinuity of an element in the uncombined state is generally longer than when the element is combined. The author attributes this to the high degree of association of rhombic S.

CHEMICAL ABSTRACTS

X-ray Investigations on the Crystal Structure of Hardened Steel Einar Ohman Jour Iron Steel Inst, London, 1931, advance copy No 12, 19 pages

An X-ray study of quenched steels confirmed the existence of the tetragonal phase, the axial ratio of which increased with increasing C content. From a consideration of these data it is concluded that martensite consists of a solid solution of C in body-centered Fe. On effective quenching the tetragonal phase has the same composition as the parent austenite, as proved by the direct relationship between C content and space-lattice dimensions. It appears probable that the C atoms dissolved in α -Fe form a complex substitutional group in which two C atoms replace one Fe atom. On tempering, the tetragonal phase decomposes continuously with a progressive decrease in axial ratio. The causes of the hardness of martensite are discussed. Forty-seven references are included.

CHEMICAL ABSTRACTS

X-ray Investigation of Certain Nickel Steels of Low Thermal Expansion G Phragmen Jour Iron Steel Inst, London, 1931, advance copy No 14, 10 pages

Precise measurements of the lattice dimensions of Ni-Fe alloys at various temperatures proved that the low coefficient of expansion of alloys containing about 36 per cent Ni is a

property of the face-centered cubic lattice of this compound and is, therefore, not due to a two-phase reaction. The study was made on alloy strips, which could be heated electrically, in a camera utilizing the Bragg focusing principle. At room temperature the maximum lattice parameter occurs in alloys containing about 38 per cent Ni. It is suggested that the specific-volume anomaly may be connected with the anomaly of expansion.

CHEMICAL ABSTRACTS

Acetylene Electrocondensation by Means of β -rays W Mund and J C Jungers
Bull soc chim Belg, 1931, XL, 158-176

In the electrocondensation of C_2H_2 with β -rays, the ratio M/I is equal to 26. A general theory of radiochemical phenomena has been developed. A crystalline structure with complex ions is proposed to explain the properties of the acetylene polymerization product and its mode of formation in the presence of inert gases.

CHEMICAL ABSTRACTS

PHYSICAL ABSTRACTS

The Aging of Ions in Air and Nitrogen
John Zeleny Phys Rev, Sept 1, 1931,
XXXVIII, 969-976

Previous work on the mobility of aged ions in air has been extended to the measurement in air and in nitrogen of mobilities of ions at different short ages. The ions were produced by alpha-rays directly in the field used for their measurement, and the average age was obtained from the time taken by the ions to cross between the two electrodes. In air containing 4 mg of water per liter, both kinds of ions of short age had the same mobility of 20 $cm^2/volt\ sec$, while at an average age of 0.18 sec the negative ions moved 8 per cent faster than the positive. In air partially dried by KOH, the mobility of the negative ions decreased from 2.3 (above units) at 0.004 sec to 2.1 at 0.34 sec, while the positive ion mobility decreased from 2.0 at 0.004 sec to 1.7 at 0.26

sec. In air dried by aid of liquid air traps, the negative ion mobility decreased from 2.44 at 0.004 sec to 2.35 at 0.28 sec. The positive ions in this dry air were found to be very sensitive to minute changes in conditions that had no effect on negative ions. These changes are supposed to arise from small traces of some unknown impurity. Positive mobilities as high as 2.3 at 0.05 sec were obtained.

The new information is applied to the explanation of the previous results for older ions. No transformation of one type of positive ion into another single type, as observed by Erikson, was found under the conditions of these measurements. The ions were all found to have the same mobility at the shortest ages, but with increase of time the ion mobilities became spread over a range of values, the numbers given above corresponding to the peak of the distribution curves. The nitrogen used contained 0.3 per cent of oxygen. The negative ions of short age all had a very high mobility which could only be roughly estimated as of the order of one hundred. With increase of age these fast ions gradually transformed into slower ions which were not all alike and had a peak mobility that decreased from 3.0 at 0.04 sec to 2.5 at 0.25 sec. The fast negative ions presumably remain free electrons for a large portion of their path, and since their mobility does not appear to change with time, it is necessary to suppose that these ions alternate frequently between being free electrons and monomolecular ions, but after more molecules become attached, the ion can no longer revert to the electron stage. The positive ions in nitrogen were always contained in one group only, the peak mobility of which ranged from 2.2 at 0.007 sec to 1.8 at 0.17 sec. The slow decrease of mobility of the ions with age and the large effect of slight changes apparently of gas composition upon the rate of this decrease for positive ions especially, indicate that the ions are gradually undergoing change of size owing to the accretion of scarce molecules or the exchange of such molecules for those which first gather about the central charge to form an ion cluster.

THE AUTHOR.

Transition Effect of Cosmic Radiation Shown by Varying the Absorbing Medium.
E Steinke Physik Ztschr, 1930, XXXI, 1019-1022

A new differential method of detecting cosmic radiation is described. Measurements of the absorption coefficient for this radiation traversing Pb, Fe, Al, water, and paraffin show that Fe and the heavier elements appear to absorb anomalously, the absorption coefficient diminishes with increasing thickness, probably because of a secondary radiation excited by the cosmic radiation in the heavier atoms. An unsuccessful attempt was made to detect scattered electrons by means of a magnetic field.

CHEMICAL ABSTRACTS

"crystallization" and with Ornstein's theory of the formation of liquid crystal groups, yet it is to be noted that these theories deal with different aspects and not the entire phenomenon

THE AUTHOR

The Number of γ -ray Quanta Emitted by Radium D E Stahel and G J Sizoo
Ztschr Physik, 1930, LXVI, 741-747

Using a special ionization chamber containing MeI, the authors measured the number of quanta emitted by Ra D and obtained the value 24 ± 0.7 quanta per 100 disintegrated atoms, which is in good agreement with Bramson's value of 31 ± 12

CHEMICAL ABSTRACTS

Comparison of Viscosity and Molecular Arrangement in Twenty-two Liquid Octyl Alcohols G W Stewart and R L Edwards
Phys Rev, Nov 1, 1931, XXXVIII, 1575-1582

A comparison is made between the X-ray diffraction halos of 22 octyl alcohols and their corresponding viscosities and an unmistakable correlation found. The assumptions are that the halos indicate periodicities, that the periodicities may be interpreted as structural in the "cybotactic" groups, and that the relative diffraction intensity of the halos computed by assuming crystal structure may be used to estimate roughly the perfection of the liquid groups. It thus is shown that there is a correlation between the coefficient of viscosity and the perfection of grouping in the direction of the length of the chain molecules. This corresponds with the reasonable view that the viscosity within the liquid groups is caused by longitudinal slippage. Moreover, since the groups at any instant occupy a large fraction of the volume of the liquid, this viscosity is an important part of that measured. This interpretation accounts for the negative temperature coefficient of the viscosity, since the size of the groups decrease with temperature.

The experiments and conclusions are in accord with Andrade's theory of momentary

The Diffraction of X-rays in Organic Mixtures Alfred Wesley Meyer
Phys Rev, Sept 15, 1931, XXXVIII, 1083-1093

An examination was made by an X-ray diffraction ionization method of the following mixtures: ethyl alcohol-methylcyclohexane, butyl alcohol-ortho-dimethylcyclohexane, quinoline-phenol, paraldehyde-cyclohexane, tetranitromethane-cyclohexane, and phenol-water. All of these mixtures are totally miscible, except the last, phenol-water, which is totally miscible at higher temperatures and is an emulsion in some proportions at ordinary temperatures. In all cases of solutions the diffraction exhibits a single major peak which has an angular position between the positions of the peaks of the constituents and shifts directly with the concentration but in general not in a linear manner. There is in some cases definite indication of the existence of secondary peaks corresponding to those found in the pure constituents but these also shift. In the single case examined of an emulsion, the major peaks of both constituents were found and the intensity of each varied directly with the concentration of that constituent. The results indicate that in a solution there exists a single type of cybotactic group and that the molecules of both constituents enter this formation. The length of the most probable

ence periodicity in the group depends upon the proportion of the liquids involved. The emulsion contains two types of cybotactic groups corresponding to the two constituent liquids. These conclusions suggest a very fundamental differentiation between solutions and non-solutions. This differentiation between solutions and non-solutions does not depend upon the fineness of the separation of either liquid. A solution exists when and only when the components, instead of having their individual space molecular groupings, conspire to form a single type of cybotactic group. With this description, the nature of a solution has a similarity to that of a crystal and has a definite concept.

THE AUTHOR

traced in some cases to certain diagram lines which had not heretofore been thoroughly investigated, and that the presence of the satellites beyond these limits is in general to be doubted, at least as far as present accuracy and sensitivity of observation are concerned. The existence and sharpness of these limits seem to be in conflict with the Wentzel-Druyvesteyn double-ionization theory of the origin of the satellites. A table of new wave lengths is included.

THE AUTHOR

Two New Methods of Interpreting Photographs Made with Convergent X-rays
O Kratky Ztschr Krist, 1931, LXXVI, 517-524

A description of two methods is given in one of which the crystal and film remain stationary, and the incident beam converges to a point on the crystal face, the angle of convergence being about 30° . The second method involves a double exposure, with a slight shift in the slit system.

CHEMICAL ABSTRACTS

Upper Atomic-number Limits for Satellites of the X-ray Line $L\beta_2$, R D Richtmyer Phys Rev, Nov 15, 1931, XXXVIII, 1802-1807

The region of the X-ray spectrum in the immediate neighborhood of the line $L\beta_2$ has been photographically studied for the elements of atomic number 50, 51, 52, 53, 56, 58, and 60, with a view to determining more precisely the atomic number ranges of the satellites (five in number) of $L\beta_2$. It appears that these ranges have clearly defined upper limits in the cases of all but one of the satellites of $L\beta_2$, and that the previously supposed presence of these satellites beyond these limits, approximately atomic number 53, can be

The Directional Distribution of Photo-electrons from Short Wave Roentgen Rays
Erich Lutze Ann Physik, 1931, IX, 853-864

The distribution of photo-electrons liberated by short X-rays was observed with a Wilson cloud apparatus using A in the expansion chamber. The observed distribution agrees with the theory.

CHEMICAL ABSTRACTS

A New Experiment Bearing on Cosmic-ray Phenomena L M Mott-Smith and G L Locher Phys Rev, Oct 15, 1931, XXXVIII, 1399-1408

This new experiment consists in combining a Wilson cloud expansion apparatus with Geiger-Muller electron-counters in a manner which allows the simultaneous study of individual cosmic-ray particles by the two methods. Its purpose was to see whether the coincidence effect in electron-counters is actually caused by the passage of an ionizing particle through them as has been generally assumed. This was considered desirable because it was felt that the several conflicting cosmic-ray experiments could perhaps be more satisfactorily explained by assuming the coincidences to be produced by photons. In this work a series of expansion photographs was taken under experimental conditions which allowed a definite correlation of an ion-track appearing in

the expansion chamber with a discharge of a Geiger-Muller counter. It was found that the discharges of a counter due to cosmic radiation are accompanied by ion-tracks resembling those due to fast β -rays from radio-active sources. This result means that, in accord with previous beliefs, the coincidence effects are caused by ionizing particles. The best assumption we can make at present appears to be that these are high-energy electrons. The possibility that these effects are due to photons appears to be excluded, so that the reconciliation of the conflicting experimental data in this field will have to follow other lines.

THE AUTHOR

Dispersion of X-rays in Calcite Louis A Pardue Phys Rev, Nov 15, 1931, XXXVIII, 1808-1815

The dispersion of X-ray in calcite has been investigated. The total radiation and the $K\alpha_1$ line from a molybdenum target tube operated at about 44,000 volts were used in different experiments. The decrement of unity in the index of refraction for the $K\alpha_1$ wave length was found to be $(2.001 \pm 0.009) \times 10^{-6}$. This does not agree with the value computed on the Drude-Lorentz theory. The specimen was a right prism with the optic axis parallel to the 90° refracting edge. No evidence was found for double refraction. The intensities of $MoK\alpha_1$ radiation reflected from calcite mirrors were measured for angles in the neighborhood of

the critical angle. These experimental values were compared with the values computed on the basis of Thibaud's modification of Fresnel's equation and found to be in fair agreement.

THE AUTHOR

The Structure of Soft X-ray Lines William V Houston Phys Rev, Nov 15, 1931, XXXVIII, 1797-1801

The experimental work on soft X-rays has shown that the lines produced by the bombardment of a solid target are much broader than those emitted by a vapor. This is due to the fact that the upper level is not sharp. The breadth and the shape can be calculated from the various models which have been used for describing the behavior of electrons in metals. The free electron model gives a line which has a sharp edge on the short wave length side. This is not observed in Be. The calculated width, however, agrees well with the observed. The bound electron model gives a more satisfactory shape for Be, but the width cannot be exactly determined. The comparison of the line shapes calculated on the basis of these two models with that observed in Be shows that, although the free electron model gives a good approximation to the zero point energy, the distribution of energy levels is strongly affected by the periodic potential in the crystal.

THE AUTHOR

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RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA

VOL XVIII

FEBRUARY, 1932

No 2

ROENTGENOLOGIC EXPLORATION OF THE MUCOSA OF THE GASTRO-INTESTINAL TRACT*

By THE COLE COLLABORATORS

FOREWORD TO AN ADDRESS PRESENTED BY INVITATION TO THE THIRD INTERNATIONAL CONGRESS AT PARIS

MR PRESIDENT On behalf of the roentgenologists of America I wish to express the appreciation of my colleagues for the honor you have done our country in assigning to America a consideration of this very important and controversial problem Realizing as I do that the literature would indicate that very little consideration has been given to this subject by them, this honor is all the more appreciated

To the American delegates, both my associates and myself wish to express our great appreciation of the honor done us in this assignment

To the members of the Congress I wish to say that the article here presented is merely a resumé of data that have been assembled in a far more extensive article which will be published serially in *RADIOLOGY*. The complete data will include the reports of personal communications from many of the foremost American roentgenologists, an extensive study of the foreign literature with translations into English, the assembling of material from the various institutions with which I am associated, and the designing and actual construction of apparatus for applying the localized pressure technic. The assembling of these data and preparation of the illustrations could have been accomplished only by the very hearty and loyal co-operation of those who are directly associated with me. This refers to Robert Earl Pound, M D, Russell Wright Morse, M D, Courtenay I Headland, M D, William Gregory Cole, M D, and Ames W Naslund, M D, who are herein referred to as The Cole Collaborators, and under which title this complete article will be published.

The honor of presenting this subject would undoubtedly have fallen to the late Preston M Hickey had he lived, and considering this fact, and the great honor and respect in which Preston M Hickey was held not only by American roentgenologists but by roentgenologists throughout the world, this complete

*Presented at the Third International Congress of Radiology, Paris, July, 1931, by Lewis Gregory Cole, M D

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The honor of presenting this subject would undoubtedly have fallen to the late Preston M. Hickey had he lived, and considering this fact, and the great honor and respect in which Preston M. Hickey was held not only by American roentgenologists but by roentgenologists throughout the world, this complete

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article will be assembled in a bound volume as a memorial to the Dean of American roentgenology, Preston M Hickey

The title "Roentgenologic Exploration of the Mucosa of the Gastro-intestinal Tract," which was assigned to us, is an unusual one, probably due to the translation from one language to another, but the term "exploration" is so applicable to the early history of this problem in which the participants were real explorers, that I am more and more pleased with the title as it was assigned

HISTORY

Reviewing the development of gastro-intestinal roentgenology as presented by Dudley Roberts before the American Gastro-enterological Association in 1928, we find that "Hemmeter must be given credit for first suggesting a way of visualizing the stomach, by means of his intra-gastric bag filled with lead solution. These experiments were not successful but were the first attempts State Normal School, Baltimore, Maryland."¹

Wolf Becker, in 1896, reported on his experiments with animals, in which experiments he attempted to fill loops of intestine and the stomach with lead solution. These experiments were not successful but were the first attempts at the use of free opaque solutions to make visible the lumen of the hollow viscera.

H P Bowditch, Professor of Physiology at Harvard University, in the Fall of 1896, suggested to Walter B Cannon that the X-rays be used as a means of studying deglutition under normal conditions. This was the beginning of Cannon's famous researches on the motor phenomena of the esophagus, stomach, and intestines. The first public demonstration of movements of the alimentary tract by use of the new method was given in Boston, Dec 29, 1896. At this time the phenomenon of deglutition as exhibited by the goose when swallowing capsules containing bismuth subnitrate was informally demonstrated by means of the roentgen rays before the American Physiological Society. The first report of the studies of the stomach of the cat was made before the American Physiological Society, May 4, 1897. Cannon was the first to use free bismuth in an opaque meal in animals, and this meal consisted of subnitrate of bismuth mixed with bread which had been softened to a mushy mass by milk, hot water, or thin gravy. Cannon, himself, states that the first published account of the use of bismuth subnitrate to make visible the alimentary tract was given by Rumpel, who, on April 20, 1897, published a report of rendering a pathologically dilated esophagus visible by pouring into it 300 c.c. of a 5 per cent suspension of bismuth subnitrate.²

¹We have in our possession a photographic copy of a letter from W C A. Hammell verifying Hemmeter's claims.

²We have recently received a personal letter from Dr W B Cannon confirming the accuracy of these statements. He has recorded the early history of his work in an article written in 1913 ("The Early Use of the Roentgen Ray in the Study of the Alimentary Canal," Jour Am. Med. Assn., Jan. 3, 1914, LXII, 1-3).

Apparently independently and contemporaneously, on June 12, 1897, and July 24, 1897, before La Société de Biologie, Roux and Balthazard presented their first reports of the use of the bismuth opaque meal in the study of the motor function of the stomach. Their full report, published in 1898, included studies of the stomach of frogs, dogs, and man by use of the bismuth opaque meal. Their studies are epochal because these writers were apparently the first to study the *human stomach* by means of an opaque meal, using 15–20 grams of subnitrate of bismuth suspended in 100 grams of water or syrup, and secondly, because they were the first to conceive the value of cinematographic study and devised a single plate-changing apparatus which enabled them to make roentgenograms of the frog's stomach at regular intervals during the progress of the peristaltic wave. Although incomplete, their observations of the gastric motor phenomena in man were exceptionally accurate.

Francis H. Williams, of Boston, deserves far more credit than he has ever received for his early recognition of the value of the roentgen rays in medicine and surgery. Perhaps this is because his extreme reticence has prevented him from claiming it or even accepting it. Williams's book, "Roentgen Rays in Medicine and Surgery," published in 1901, is an early classic. Williams, assisted by Cannon, on Sept. 23, 1899, administered an ounce of bismuth subnitrate in a meal, consisting of a pint of milk into which bread had been broken, to a child ten years of age. Fluoroscopic studies were then made, and twelve tracings made of this and another case at various stages of gastric evacuation and in different postures were recorded in Williams's book in 1901. The findings which are there recorded are remarkably accurate as regards the changes in size, shape, and position of the stomach as the result of respiration, change of posture, and digestion. Williams's Fig. 201 is a reproduction of a tracing which had previously been published in the Transactions of the American Climatological Association, 1898. This was a "cut of a tracing made by means of the fluorescent screen from a girl seven years old, showing the outline of the stomach one hour after a meal of bread and milk containing subnitrate of bismuth."

At the Boston City Hospital, where Williams is an attending physician, he has never allowed the title of "roentgenologist" or "radiologist" to be employed. The appointment is recorded as "physician in charge of the X-ray Department." It has always been his conception that the roentgenologist should primarily be a physician rather than a laboratory worker, and that he should be interested in all phases of medicine rather than limit himself to the making and interpretation of roentgenograms. At the present time the justification of his attitude toward this problem is just becoming recognized. It gives us great pleasure to herewith reproduce an autographed photograph of Dr. Francis H. Williams in recognition of his great wisdom concerning the status of the roentgenological physician.

Einhorn, on April 1, 1899, at the office of Willy Meyer, used the X-ray in

a single case to demonstrate a powder blower which he had designed for applying medication to the gastric mucosa

"In 1898, Holzknecht began using small dose of bismuth in aqueous suspension, especially for the study of the esophagus on a firm basis, but the visualization of the stomach and intestines was not furthered by such meals" (Roberts)

Then for almost half a decade there was a silent era broken only by the contributions of O Kraus and Lommel. A schematic chart (Fig 2) helps one to visualize the time relation of the historical events.

Nearly five years later (1904), Rieder, of Munich, with much more publicity and without giving due credit to Roux and Balthazard and no credit to Williams, advocated the use of a meal, the composition of which was almost identical with that previously described and employed by Williams. As a result of Rieder's announcement, this opaque meal of gruel and bismuth became known the world over as "Rieder's meal."

During the following years, 1905-1909, fluoroscopic exploration of the gastro-intestinal tract, with "symptom-complices" as the criterion on which the interpretation of the findings was based, became the vogue, particularly on the Continent. Until 1909, Austria and Germany led the world in this work and among the leaders the names of Holzknecht, Strauss, Rieder, Schwartz, Kreuzfuchs, Groedel, Albers-Schonberg, Haenisch, and Kienbock are outstanding. Many students from all over the world, and particularly from the United States, were attracted to the clinics of Austria and Germany.

An explanation of this popularity of fluoroscopy and symptom-complices is found in the fact that at this time roentgenography of the moving parts was most unsatisfactory. During these years the mechanics of producing X-rays and roentgenograms had not developed sufficiently so that one could obtain satisfactory roentgenograms of the gastro-intestinal tract. Intensifying screens had been employed for the intensification of the photographic effect of the ray in scientific experiments, but these had not yet come into practical use for gastro-intestinal roentgenography. The only two methods of exciting the X-ray tube were by the static machine and by the coil. Neither the static machine nor the coil, however, was powerful enough to make satisfactory roentgenograms in a sufficiently short period of time to avoid blurring incident to the movement of the gastric peristalsis. The slower movement of the colon rendered roentgenography more practical in this region than in the stomach or small intestine. At one time from fifteen to twenty minutes were required to make an exposure of the abdomen as for a kidney stone. By 1903-04, as a result of gradual improvements in apparatus, the time of exposure had been reduced to fifteen or twenty seconds so that roentgenograms could be made of the kidney stone while its motion due to respiration was stopped. Sufficiently rapid exposure to avoid the motion of gastric peristalsis, however, continued to be impossible. Roentgenograms of the stomach were so blurred that they were of little or no diagnostic value. Both methods

of exciting the tube, however, were sufficiently strong to enable one to observe fluoroscopically the size, shape, and position of the stomach, as well as some of the grosser lesions of the stomach, when present.

In the United States the resurrection and further development of gastro-intestinal roentgenology dates from 1905. In that year, Hulst, who had visited Rieder in Munich, informally presented roentgenograms of the gastro-intestinal tract at the annual meeting of the American Roentgen Ray Society in Baltimore. The following year, as his presidential address before the American Roentgen Ray Society, he presented an illustrated comprehensive paper on the roentgenographic method of examination of the gastro-intestinal tract which was so complete that it furnished a new impetus to the method. Williams had suggested seven years previously. In this paper Hulst accords credit to Williams for giving one ounce of bismuth in emulsion as early as 1897, and it may be this fact to which Williams refers (p. 359 of his book).

The Advent of the Transformer and Screen.—At the same meeting (American Roentgen Ray Society, 1906) at which Hulst resurrected gastro-intestinal roentgenology, Snook first presented the electrical facts upon which he developed and made practical the transformer which superseded the static machine and coil. Snook developed the transformer in 1907, and this, with the improvement and application of the intensifying screen, enabled exposures to be made in a fraction of a second—thus the blur, due to movement of the stomach, was eliminated.

Prior to the advent of the transformer and intensifying screen, bismuth was suspended in a thick gruel which prevented it from filling the crevices between the rugae. When roentgenograms that showed greater detail became available, bismuth was suspended in buttermilk, which allowed the mixture to seep into the spaces between the mucosal folds in a manner that it could not do when suspended in thick gruel. Then, for the first time, routine plates were made which showed the rugae of the stomach. With this technic it was possible to observe any growth that protruded sufficiently deeply into the stomach to cause an irregularity of the contour, which was then termed a "filling defect." It was possible also to note spasm of local regions of the stomach or pressure from without, likewise causing a similar "filling defect." In a filling defect due to spasm (Fig. 3) the rugae were observed within the deformed area, however, in a filling defect caused by a growth protruding into the lumen of the stomach (Fig. 4), the rugae were singularly absent. Thus, as far back as 1908-09, the first of the four fundamental findings that will later be described, namely, alteration in contour, and the fourth of these findings, the pattern of the mucosa, were already considered of paramount importance in the diagnosis and differential diagnosis of gastric cancer. There then ensued a long and bitter controversy concerning the relative value of symptom-complexes observed fluoroscopically and morphology observed roentgenographically as criteria for the interpretation of roentgenological findings into gastro-intestinal diagnosis.

The main contention on the part of those who objected to morphology observed roentgenographically as the proper criterion for diagnosis was that various roentgenograms of the same stomach differ so much in their appearance that a conclusion could not be drawn from the evidence on a single plate. The proponents of the morphologic basis of X-ray diagnosis proceeded to obviate this difficulty by making a series of plates in as rapid succession as possible. As a result, the factor of change in contour that before had been regarded as a disadvantage, proved in reality to be of great assistance. Subsequently this pliability of the gastric wall became the corner stone on which to build roentgenologic gastric diagnosis, and the making of a series of plates in rapid succession was promptly adopted by some observers as a routine procedure and was called "serial roentgenography."

In 1909, Kaestle, Rieder, and Rosenthal attempted to make roentgenocinematographic films of the stomach under the term "bio-roentgenography." They assembled roentgenograms of a normal individual and reproduced these cinematographically to illustrate the normal motor phenomena of the stomach. Through the courtesy of George E. Brewer and William G. Lyle, who was then private physician to E. H. Harriman, the author had the opportunity to observe this roentgenocinematographic demonstration of Kaestle, Rieder, and Rosenthal. This procedure was applied to the study of the motor phenomena of the stomach. Subsequently I was able to find only one cinematographic film which was a reproduction of serial roentgenograms made by their method. With few exceptions, particularly Meyer of Berlin, this method was not accepted on the Continent as a practical method of roentgenological diagnosis of gastro-intestinal lesions.

In 1909 the author began making from ten to twelve plates of the stomach in each of three postures, the erect posture, the prone posture, and the prone oblique posture in which the patient lies on the right side, as a routine procedure for the study of the stomach in every gastro-intestinal examination. To this method he applied the term "serial roentgenography." Because of the frequent intentional and unintentional misinterpretation and misuse of this term, it is best to define here what is meant by "serial roentgenography" as applied to the stomach. Serial roentgenography is a series of eight or more roentgenograms made of the filled stomach in one posture of the individual, these roentgenograms to be made at intervals of from four to ten seconds, so that in this series all of the phases of the gastric motor phenomenon will be depicted. In order to be of value such a series of roentgenograms must be made with the individual in two different postures, the erect and prone, and in two directions, the postero-anterior and oblique. Serial roentgenograms (Figs. 5 and 6) are of limited value unless they are observed on an illumination box of sufficient size so that they may all be observed at once and compared one with another.

During this time the symptom-complex method was used almost exclusively on the Continent. In America, however, during the period of intense

development of the direct method there were many minor skirmishes between advocates of the two methods. The real battle occurred in Chicago at the meeting of the Mississippi Valley Medical Association in 1912. Skinner was the advocate of the Continental method. Selby, also favoring the Continental method, was roentgenologist at the Mayo Clinic at the time, and, acting under instruction, stated that, while the X-ray was useful in examining bones and lesions of the kidney and chest, it was valueless fluoroscopically and otherwise as a method of diagnosis of gastro-intestinal lesions. Your essayist presented a series of roentgenograms in support of his contention on behalf of the direct method. These roentgenograms illustrated characteristic deformities of the lumen of the gut that are caused by certain pathologic lesions, particularly cancers, gastric ulcers, postpyloric ulcers and gall-bladder adhesions, calling attention to the points of differentiation among them. This brought the two methods into direct controversy, which raged for a number of years. Carman, who succeeded Selby as roentgenologist at the Mayo Clinic, rather elaborately described a group of what he called "roentgenologic signs" as a basis for the diagnosis of gastro-intestinal lesions. These roentgenologic signs represented the principles included in the symptom-complexes, but, in addition, included the direct detection of some of the grosser pathologic lesions by fluoroscopic examination. He was the last influential advocate in the United States of the symptom-complex method of diagnosis.

Among the earlier supporters of the direct method of examination, Arial George gave the essayist more support than any other person, particularly in the diagnosis of postpyloric ulcer, and this subject became the storm center of a cyclonic controversy in Boston in 1913.

At the time that the serial method was being established it was noted that the mucosal pattern was of great significance, especially in the diagnosis of organic lesions and the differential diagnosis of malignant lesions from spasm. With the roentgenographic technic it was observed that any growth which protruded into the stomach caused an irregularity of contour known as a "filling defect." Spasm of local regions of the stomach or pressure from without caused a similar defect. In a filling defect due to spasm or pressure, the rugae were observed within the deformed area, however, in a filling defect caused by a growth protruding into the lumen of the stomach, the rugae were singularly absent. Thus, as early as 1909 the first of the four fundamental findings (Fig 4), alteration in contour, as well as the fourth fundamental finding, the pattern of the mucosa (Fig 3), became of paramount importance in the diagnosis and differential diagnosis of gastric cancer.

A special technic was, therefore, developed to accentuate the mucosal patterns. This special technic consisted of sedimentation of bismuth from a thin watery suspension onto the anterior or posterior gastric wall. Details of this technic will be described later. However, at this time we are submitting illustrations to show that the characteristics of the mucosal pattern were even then considered of significance. The roentgenogram illustrated

in Figure 7 was made on October 13, 1910, and represents the essayist's first attempt to demonstrate the pattern of the gastric mucosa by a special technic. The roentgenograms illustrated compare favorably with the more modern methods of observing the mucosal pattern.

For a time both the serial method and the special mucosal technic were used on the same patient in order to determine which would be the more satisfactory to adopt for the routine procedure. The serial method with a moderately filled stomach, although far more extensive and, therefore, more expensive, seemed to us to be of much greater value than the special mucosal technic, and was, therefore, adopted as our routine method of examination. The special mucosal technic was used only as an adjunct in certain specific cases. Serial roentgenography was also applied to the mucosal technic (Fig. 8).

At this time the spirit of the pioneer was rampant and we moved from one field of exploration to another with such rapidity that we could not "get organized." These were grand and glorious days to which all subsequent exploration seems tame. Now as I review the evidence that we then assembled, it seems as though there is little that has been added in the last two decades. In proof of this we are largely illustrating this communication with roentgenograms made during this early period.

History of Roentgenological Methods for Study of the Mucosa.—A thorough comprehension of modern technic as employed by various investigators of the gastro-intestinal mucosa is essential to an understanding and interpretation of their findings. Åkerlund, 1921, rediscovered the direct method and published an extensive monograph on duodenal ulcer in which he discussed at length the deformities of the "duodenal bulb" incident to ulcer. He directed particular attention to the correlation of the morphological changes observed in the roentgenograms and the anatomic-pathologic changes observed in specimens obtained by operation and autopsy. This work created or marked the beginning of a new era in roentgenology of the gastro-intestinal tract as practised by roentgenologists on the Continent. Symptom-complices were forgotten. The direct roentgenological detection of morphologic changes in the wall of the gut became the fashion. This revived on the Continent the same old controversy concerning the relative value of symptom-complices and direct morphology which had been definitely settled in the United States a decade earlier.

Åkerlund mentioned the "method of the thin layer," explaining that by exerting external pressure upon the duodenal bulb all but a thin layer of the opaque contents may be forced out of the cap, bringing to view the markings of the mucosa and ulcer craters which otherwise would be obscured. Bastrup and Rendich, in 1923, published papers dealing with special methods for demonstrating the pattern of mucosal folds in the stomach. These ideas were greeted as a new departure. Many observers became "mucosa conscious." Yet, whenever a certain idea or method becomes the center of inter-

est, it is always wise to look back over the literature to see what is new and what is a revival of someone's previous work

In the following section we shall present chronologically the history of certain technical methods of roentgenologic examination of the gastro-intestinal tract. The general story of the usual methods has been presented in the previous chapter, so, at this time, more detail will be devoted to the technical methods of study of the mucosa.

Rieder, 1904, noticed after a bismuth enema had been injected, and after the patient had been standing for a few minutes, that the bismuth would precipitate out of solution into the dependent part of the haustral divisions of the colon, and that this outlined the haustral divisions much more clearly than would the solution originally injected. This was illustrated by him at that time.

Holzknecht and Brauner, 1906, used a watery suspension of bismuth subnitrate in the preliminary part of the fluoroscopic study of the stomach (10 gms bismuth subnitrate in 50 gms water, to which is added a tablespoon of milk sugar). Palpation of the stomach in the erect posture made possible the visualization of the mucosal folds. After this procedure, and while the stomach still contained the bismuth suspension, they distended the stomach with gas by having the patient ingest an effervescent mixture of from 4 to 5 gms of tartaric acid and from 5 to 7 gms of sodium bicarbonate. The usual opaque meal consisted of 400 gms of milk gruel and 35 gms of bismuth subnitrate.

Independently, F M Groedel and Erich Meyer, in 1908, recommended the substitution of bismuth subcarbonate for bismuth subnitrate. Due to impurities frequently present in the bismuth subnitrate there was the danger of poisoning from the use of this salt.

The essayist, in 1909, with intent to show the mucosal folds, used the principle of sedimentation of bismuth subnitrate from a watery suspension as a special technic for the demonstration of the mucosal pattern on the anterior and posterior walls of the stomach (Figs 7 and 8).

Bachem and Gunther, 1910, introduced the use of barium sulphate. Cannon used or suggested the use of barium sulphate as early as 1904.

The mixture of opaque salts with gruel formed a stiff meal which did not readily fill the folds of the mucosa of the stomach. For this reason, after about 1908, in the United States, the opaque salts were mixed with buttermilk. This formed a non-sedimenting suspension of fluid consistency.

Stiller, 1910, criticized the use of the bismuth gruel opaque meal, claiming that its use produced an abnormal condition of the stomach due to the high specific gravity of the meal and the astringent influence of bismuth upon the stomach. For several years there was considerable controversy on this subject.

von Elischer, 1911, working to settle this controversy, sought to study the stomach with a contrast substance, of the smallest amount necessary to make

the stomach completely visible, and one which would do away with the high specific gravity and possible chemical irritation of the bismuth meal. He used a thick fluid emulsion mass composed of 75 gms of "Zirkonovyd" and from 30 to 40 c.c. of mucilage of acacia. Of this emulsion, from 30 to 40 c.c., which has a weight of from 50 to 60 gms, was injected into the stomach through a tube. The patient was then placed prone in different positions for from five to ten minutes so as to get an equal distribution on the mucous membrane of the stomach. von Elischer found that the emulsion distributes itself over the entire inner surface and fills the folds of the mucous membrane. He considered that this method showed the shape of a gastric tumor more accurately than the usual opaque meal. He also used inflation of the stomach with air in combination with the contrast emulsion.

Forssell, 1913, states "The relief of the mucous membrane can appear inside of the flatness of the roentgen picture in case a less opaque content is used, or if the content is distributed in a thin layer (von Elischer's method)." Åkerlund, 1921, working in association with Forssell, applied the method of the thin layer to the roentgenologic diagnosis of lesions of the duodenal bulb by using external pressure to displace from the bulb all except a thin layer of the opaque content.

This same method was immediately adopted by Eisler and Lenk, 1921, who used small amounts of barium solution, together with pressure from without, regulated under fluoroscopic control, for the study of the inner surface (mucosal folds) of the stomach.

Baastrup, in a paper read in June, 1923, suggested two methods for obtaining films of the mucous membrane of the stomach. The first method was inflation of the stomach with air saturated with barium powder (similar to a method advanced by Laurell for the examination of the colon). The method was difficult to employ and was soon abandoned. This was similar to the blower demonstrated by Einhorn in 1899. The second method is based upon the physiologic studies of rats' stomachs and the studies on humans of Kaufmann and Kienbock (1911), by which it has been shown that the food latest partaken of gets inside of the food first ingested. "The patient, while still fasting, is given, first, half a tablespoonful of barium sulphate stirred up with water to a smooth, rather thick emulsion, then, shortly afterwards, about seven ounces of smooth rice-flour porridge, of rather thick consistency and flavored with a little powdered cinnamon or sugar, but without any thin fluid."

Rendich, 1923, used a thick emulsion very similar in nature to that previously described by von Elischer. Mucilage of acacia 50 per cent (powdered gum arabic to an equal volume of water) was employed, to which an equal quantity (by volume) of bismuth subcarbonate is added. Honey was also substituted for the mucilage of acacia but did not prove as satisfactory. This emulsion was administered to the patient while he was in the partially recumbent position (10° incline). In this communication Rendich does not

make any mention of the previous work which had been done, particularly of the work of von Elischer, which he practically duplicated, and does not mention that while studying in the Army Training School he became fully conversant with your essayist's method of sedimentation of bismuth from thin watery solutions onto the anterior and posterior walls of the stomach.

Pribram and Kleiber (1927), Hilpert (1928), and Vallebona (1926) have revived the combined use of a barium suspension and air distention. The work of Pribram and Kleiber has been limited to the duodenum, while that of Hilpert and Vallebona has had to do with both the stomach and duodenal bulb. Small amounts of barium suspension are ingested and distributed between the rugæ by manual pressure and then the stomach is distended by air injected through a small tube (Pribram and Kleiber, Hilpert), or by chemical means (Vallebona). This method has the disadvantage of diminishing the prominence of the mucosal relief by the distention of the stomach and duodenum.

Trautner and Hoecker, 1927, introduced into the stomach a tube, the end of which was covered with a thin rubber bladder. The bladder was moderately distended with air, and then a small barium meal was given which would settle between the bladder and the gastric wall.

Certain phases of the work of three observers, Åkerlund, Berg, and Chaoul, demand special attention. Åkerlund and Berg use, as a contrast mixture, barium and water in the proportion of three parts of barium to four parts of water. Chaoul uses a mixture of barium, tragacanth, and water. With all three of these observers the element of pressure is the main part of the procedure in securing the distribution of the opaque medium and in acquiring the optimal demonstration of the mucosal pattern.

Åkerlund originally maintained that the method of applying pressure should be as simple as possible. He used the Forssell fluoroscope, designed for both fluoroscopy and roentgenography. The screen of this fluoroscope is so arranged that it may be pressed against the patient and locked in position with the maintenance of any desired degree of pressure. For localized pressure, Åkerlund inserted between the screen and the patient pads of hard cotton, wool, cork or other non-opaque material. Subsequently, he has developed two other methods of pressure. The first is a cone which may be attached to the back of the fluoroscopic screen, into the end of which cone is mounted an inflatable rubber bag. The finer degrees of pressure are obtained by inflation of this rubber bag. The second method is a larger tube to which has been adapted a skillfully designed carrier containing a rotary Bucky diaphragm, and cassette holder. The desired amount of pressure is first secured by fluoroscopic observation, and then the carrier of the Potter-Bucky grid and cassette is substituted for the fluoroscopic screen. The carrier must be withdrawn and reloaded for each exposure, which renders rapid, frequent exposures impossible.

Berg also uses a fluoroscope designed for both fluoroscopy and roentgen-

ography Pressure is obtained by a tube mounted on the back of the fluoroscopic screen His apparatus is so arranged that at the moment he sees a fluoroscopic image which he wishes to record, almost instantaneously a cassette is dropped into place, the transformer setting is changed for roentgenography, and the exposure is completed

Chaoul exerts pressure through a rubber bag strapped in position by means of a leather belt and under fluoroscopic control Serial roentgenograms are made with the patient in the prone position on a roentgenographic and indirect fluoroscopic table similar to the Cole table Chaoul uses the fluoroscope only for localization and for the control of the pressure exerted by the inflated rubber bag

Colon—The universal method for roentgenographic examination of the colon has been to fill the colon completely with an opaque clyster This was originally used by Rieder (1904) With some modifications in the composition of the opaque solution this method has remained the routine procedure Laurell (1921) and A W Fischer (1923) suggested the combined use of an opaque suspension and air injection Laurell injected the colon with air while it was filled with a barium meal Fischer administered a barium enema, then had the patient evacuate the enema, after which a small amount of the opaque suspension remained in the colon He would then inject air into the colon Some of the opaque suspension would remain as a coating on the wall of the colon and its shadow would be sharply defined from the shadow of the air distending the colon This procedure, of course, would show the mucosal surface with the lumen of the colon distended and, therefore, with a minimum folding of the mucosa

The more common procedure has been to study the colon after evacuation of the opaque enema, at which time the mucosal folds are most prominent, due to contraction of the colon, and are well outlined by the thin layer of opaque mixture which remains in the contracted areas of the colon after evacuation This method has been used extensively by Knothe, Berg, Fischer, and Pansdorf, as well as by Frick, Bluhbaum, and Kalkbrenner, and has been routinely used by your essayist since 1915

In the following sections we present a resumé of our own technical methods and certain principles of procedure which have been found helpful These are discussed under four headings

- (1) Apparatus—Technic of Serial Roentgenography
- (2) Preparation of the Patient.
- (3) Choice and Administration of the Opaque Medium, and Roentgenographic Projection and Posture of the Patient
- (4) Application of the X-rays

(1) APPARATUS—TECHNIC OF SERIAL ROENTGENOGRAPHY

Considering the numerous exposures which are necessary for serial roentgenography, it is essential for economic reasons that the roentgenograms

should be as small as is practical to show the region being examined. Extremely small films of the cap and valve are not satisfactory except as complementary evidence used in conjunction with larger films of the entire stomach. To show the entire stomach we have used as small as $6\frac{1}{2} \times 8\frac{1}{2}$ films but prefer 8×10 films for this purpose. We prefer single films for each exposure, rather than multiple exposures on a large film. Multiple exposures on large films are used by some roentgenologists to simplify developing. When this is done the large film should be cut later into single exposures so that the roentgenograms may be matched over each other.

In order to use small films some sort of apparatus which enables one to center the stomach under fluoroscopic control is essential. The reflecting fluoroscope with the mirror set at a 45-degree angle is the best and safest device, especially for the prone posture. The 45-degree angle of the mirror is very essential. Our gradual development of this apparatus in the early days of gastro-intestinal roentgenography and the fact that in some simple form at least it was available in all the institutions with which I was associated, prevented me from recognizing how difficult it was to practise serial roentgenography without such an apparatus. However, when my office was burned in 1924, we were compelled to practise serial roentgenography for a time without such an apparatus, and for the first time I appreciated the difficulties of those who attempt to do serial roentgenography without a convenient method for centering the stomach and changing the films or cassettes.

Why manufacturers are unwilling to build the simple device which we have employed for so many years without making some change of their own that renders it impractical, and why roentgenologists shy from the application of the 45-degree mirror visualization of the fluoroscopic screen with some simple film-changing device, and why they attempt numerous complicated impractical substitutes similar to that recently described by Grier at the meeting of the American Roentgen Ray Society, is one of the mental quirks that it is difficult for me to understand.

The serial table which we use in my private office (Fig. 9) was built as an emergency table just after the fire in 1924 and we have used it ever since. It is so simple that it may be built by any carpenter and, therefore, it does not elicit the interest of the manufacturers of X-ray equipment. It is a box 40 inches high, 36 inches wide, and 7 feet long, placed against a partition which may be a permanent wall or a portable partition which separates the table from an operating booth. Figure 10 shows the details of construction.

Any standard cassettes may be used in a lighted booth. Only one set of screens is necessary if the booth is dark, otherwise, 6 or 8 cassettes with 12 or 16 screens are necessary. The same principle is used for the erect position, with the patient standing at the foot of the table.

A more elaborate serial table has been designed and constructed by one of us (C. I. H.) that may be used without a booth, but it requires cassettes unless it is operated in a darkened room (Fig. 11).

A very simple device consisting of a box about 20 by 24 inches and 10 inches deep, with one side open and a bakelite panel in the top, with a mirror to reflect the image of the fluoroscopic screen, and a horizontal shelf to apply the cassettes to the under surface of the patient, is the simplest of all (Fig 12) With a wooden leaf at each end which folds back on the top, this box can be placed on any table, and when not in use the leaf at each end folds back on the top of the box and it may be placed on the floor and used as a convenient stool or step This device was first used at General Hospital No 1 and was dubbed the "Baby Grand "

The value of serial films is very greatly diminished unless one has illuminating facilities so that all the films can be observed and studied at once, and, therefore, an illuminating box 40 inches high and at least 8 feet long is essential

A much more elaborate roentgenocinematographic apparatus has been installed in the Joseph Purcell Memorial Laboratory at the Fifth Avenue Hospital, through the generosity of his wife, Anna Purcell True moving pictures of the stomach and intestine may be made with this apparatus on a roll film 10 inches wide This film is perforated at the edge and may be moved 10 inches between each exposure By use of a gear shift, similar in size and construction to an automobile gear shift, several different speeds may be used Exposures may be made at the rate of 4 per second, 3 per second, 2 per second, 1 per second, or 1 every two seconds, or single exposures at any time interval desired This apparatus may be used either in the horizontal position for the prone or supine postures, or in the vertical position for the erect posture It is shown in Figures 13 and 14 The large film may be reduced to the standard 31 mm (Fig 15) or the sub-standard 16 mm film and projected either from a standard or sub-standard motion picture projector, showing not only the motion of the stomach but that of the small intestine, and the relation of rapidity of motion of one to the other [This film was demonstrated at the Third International Congress of Radiology in Paris, July, 1931]

(2) PREPARATION OF THE PATIENT

For an examination of the esophagus, stomach, and small intestine, the patient should be in an over-night fasting condition, without catharsis Even with this precaution and in cases without obstruction, small amounts of food residue are not infrequently found to be present in the stomach In such cases a longer period of starvation may be necessary After gastric lavage or after expulsion of the test meal, small quantities of the lavage fluid and of the test meal remain in the stomach and blur the outline of the barium shadow This is particularly important in the study of the surface of the mucosa by the "thin layer technic" Food remnants, mucus, and air bubbles all produce a confusing mottling of the shadow which may completely destroy

all the finer detail. For an examination of the colon or small intestine by colon enema, the patient should have a thorough catharsis, preferably by castor oil (from 1 to 2 ounces). The cathartic should be given twenty-four hours before the examination is to be made. Waiting twenty-four hours after the giving of the cathartic allows the spastic effect of the cathartic to subside and does away with troublesome spasm during the giving of the enema. Fasting is not essential.

In the colon, as in the stomach, the presence of food remnants (feces) produces a mottling of the contrast shadow which destroys the fine detail and often simulates in appearance certain pathologic findings. We do not believe that the colon can be satisfactorily evacuated by the aid of cleansing enemas. Not only does this method fail to evacuate all of the fecal material, but there is, also, a retention of part of the cleansing solution—which is just as disturbing as the original contents of the colon.

(3) CHOICE AND ADMINISTRATION OF THE OPAQUE MEDIUM AND ROENTGENOGRAPHIC PROJECTION AND POSTURE OF THE PATIENT

As the opaque substance we use, routinely, chemically pure barium sulphate for examination of all parts of the gastro-intestinal tract. We use the single opaque meal, following the progress of this meal through the entire gastro-intestinal tract. This serves to establish the emptying time of the stomach, identifies all parts of the intestinal tract, and indicates the progress of the ingested meal through the small intestine and colon. *If there is any suspicion of an obstructive lesion in the colon, the study of the colon by means of the barium enema should precede the barium meal.*

Esophagus—For an examination of the esophagus we use a thick paste of barium and water, so thick that the patient cannot swallow it without mixing it with saliva. This thick paste will pass down the esophagus slowly and some of it will remain in the esophagus for a considerable period of time, even with the patient erect. Fluoroscopic and roentgenographic examination may be made in either the erect or supine posture. For the usual roentgenographic examination and to obtain a greater filling of the esophagus it is best to administer the paste to the patient while he is in the horizontal position. For a study of the peristalsis in the esophagus Palugyay elevates the pelvis above the level of the shoulders so that the opaque paste must be forced up an inclined plane.

The esophagus must be studied in the antero-posterior and both oblique projections, exactly as one would step around a tree in order to study its outline.

The demonstration of the mucosal surface by a thin layer depends upon the retention of the opaque substance between the folds of the mucosa or its adherence to the surface of the mucosa. This is difficult to control. We believe this can be best accomplished by originally giving a very small amount

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Examinations are made routinely at one-half, two, four, and six hours after ingestion of the barium meal, but may be made at more frequent intervals if necessary

It is *absolutely* essential, if one is to obtain the best roentgenograms of the small intestine, that there be no nutrient value in the menstruum in which the barium is suspended. This eliminates buttermilk, malted milk, and, also, flavoring extracts. Sustained fasting is essential.

Roentgenographic examination of the small intestine is made only with the patient in the prone position. Comparative roentgenograms were made in both the prone and erect postures and it has been found that (1) The position of the small intestine varied but little in the two postures, (2) the loops of the small intestine were more discretely shown in the prone position, (3) there was no appreciable distortion of the small intestine in the prone position.

It must be remembered, however, that the preceding remarks regarding the position in which the small intestine is studied apply to the use of the barium meal. When one is examining the abdomen to determine whether or not there is an abnormal dilatation of any of the loops of the small intestine by gas due to obstruction, the erect posture is very helpful, in that it allows one to visualize fluid levels in the gas-filled intestine.

Pansdorf varies this procedure slightly in that he does not give the barium meal at one time, but in fractions, the patient taking one swallow every ten or fifteen minutes. This diminishes the bulk of the opaque mixture in the intestinal coils and does not serve as well to demonstrate their caliber.

The colon as outlined by the barium meal is examined daily, the roentgenograms revealing the progress of the barium meal through this region.

Visualization of the Mucosal Pattern of the Stomach—The visualization of the mucosal pattern depends fundamentally upon a satisfactory distribution of an opaque suspension in the furrows between the mucosal folds. There are two methods (1) The use of a moderate amount of a thin suspension of an opaque salt, through which can be seen the shadow due to displacement of the opaque suspension by the folds of the mucosa, and (2) the methods of the "thin layer".

In roentgenograms made with the first method the folds are shown as less opaque linear shadows within the flat whiteness of the gastric shadow. This method has the disadvantage that the shadow of the opaque suspension as a whole lacks sharpness because of the small content of opaque material.

The method of the "thin layer" may be applied in several ways. The bulk of a full or small sized barium meal may, by external pressure, be displaced from a local region of the stomach or cap, leaving only a thin layer which does not conceal the shadows of the thicker layers of opaque substance which are present in the furrows between the mucosal folds.

The more common and satisfactory procedure is to give only a small amount of the barium-and-water mixture (8.5), a sufficient amount to fill

—a level teaspoonful—of the thick paste. This will usually be sufficient to leave a thin coating of barium on and between the folds of the mucosa.

The Barium Meal.—The contour of the stomach, we find, is best shown after a full barium meal—8 oz by weight of barium to 5 oz of water—is administered. This amount—7-oz volume—is less than that employed by most observers but is all that is necessary. Over-distention of the stomach is undesirable as it not only gives a less satisfactory visualization of the stomach and cap, but, also, causes the stomach to obscure an unnecessary amount of upper intestine. This amount of barium insures that the margin of the gastric shadow will be very sharp.

To establish the contours of the various surfaces of the stomach, roentgenograms should be made in the postero-anterior projection and both the right and left oblique projections. For the right, or first, oblique projection, the right side of the patient is against the film, for the left, or second oblique projection, the left side of the patient is against the film.

Roentgenograms made in the postero-anterior projection should be made with the patient both erect and prone, as the profile of the postero-anterior projection is not the same in the erect and prone postures.

The oblique projections may be made with the patient either erect or prone. We believe that the erect posture is preferable, as the anterior and posterior surfaces of the stomach are brought more into profile with the patient erect. In the prone-oblique posture there is a rotation and a lateral shift in position of the stomach.

The roentgenographic examination of the stomach in the erect position should be made as soon after ingestion of the barium meal as the cap and duodenum begin to fill. One of the chief sources of failure to obtain good roentgenograms in the erect posture is that the making of the roentgenograms is delayed by fluoroscopic examination until the gastric muscle has lost its tone and is unable to hold the barium in a column. Early lack of tone and peristalsis may be stimulated by external irritation, either a slap with the hand or a dash of cold water.

When an individual assumes the supine position most of the gastric contents flow back into the fornix of the stomach. This position is very useful when one wishes to study the upper part of the stomach in a dilated state.

The Small Intestine.—The same moderately thick mixture of barium sulphate and water (8 5) serves as the best medium for a roentgenographic visualization of the small intestine. The following conditions must be fulfilled to secure roentgenographic visualization of the small intestine:

- 1 The opaque medium must be of such composition and consistency that it will pass out of the stomach at a fairly rapid and uniform rate of speed.
- 2 The medium must be of sufficient consistency to pass evenly—and, preferably, very slowly—through the small intestine.
- 3 Roentgenographic examinations must be made at intervals which will show the various parts of the small intestines when they are best filled.

The Barium Clyster—The solution which we use is a suspension of barium sulphate in mucilage of acacia and water 10 ounces by weight of barium sulphate, 7 ounces of mucilage of acacia, and 32 ounces of water. This solution should be warmed to body temperature before injection. The injection is made by gravity through a rubber enema tube to the end of which is attached a funnel. The rapidity and pressure of the injection is controlled by the height of the funnel above the patient's body. The use of the funnel allows one to see at all times whether or not the suspension is going in rapidly, or slowly, or not at all. Back-flow of the suspension into the funnel is due to temporary contraction or spasm of the colon. The suspension should be injected slowly and at a low pressure. If this is done, one rarely fails to fill the normal colon completely. The injection is followed under fluoroscopic control and should be stopped as soon as the cecum is filled. Over-distention of the colon is a disadvantage.

When the colon is completely filled, a roentgenogram is made with the patient in the prone position, the ray being projected in the postero-anterior direction. As in other parts of the intestinal tract, we are dealing with a tube which must be viewed from several angles to bring its several contours into profile. This is particularly true of the colon because of the usual overlapping of the transverse colon and the ascending and descending colon at the hepatic and splenic flexures, respectively. Therefore, roentgenograms should be made in both the right and left prone-oblique positions, with sufficient rotation of the patient's body to make visible, in turn, these two flexures of the colon. This procedure is an excellent protection against the very real possibility of overlooking a lesion due to overlapping of the different parts of the colon.

After these roentgenograms have been made, the colon should be evacuated, either by the patient or by drainage through the enema tube. The study of the colon after evacuation is just as important as the study of the filled colon. It is essential to know whether or not there is an unusual retention of any division of the colon, particularly proximal to the hepatic flexure. In addition, a thin layer of the barium mixture remains on the mucosa of the colon and gives an excellent demonstration of the mucosal pattern of the contracted colon. The studies by Knothe, Berg, and Frick, Bluhbaum and Kalkbrenner of the mucosa of the colon have all utilized this slight retention of the opaque mixture after evacuation.

A W Fischer (1923) recommends the combined use of an opaque mixture and air injection. He uses the usual opaque mixture. After evacuation, he studies the mucosal pattern of the contracted colon, and then injects air into the colon. A thin layer of opaque mixture adheres to the surface of the mucosa and when the colon is distended with air, one obtains, at times, an excellent visualization of the mucosal surface. The results are difficult to control and duplicate.

the furrows but not enough to cover the folds. If too little of the barium mixture is used, some of the furrows may not be filled. If too much is employed, the mountain peaks of the mucosal folds may be so flooded by the mixture as to be completely obscured in the roentgenogram.

The greatest difficulty with this method is to secure a satisfactory distribution of the small amount of barium mixture in the stomach. Special methods for the distribution of the barium have been devised to show the rugae most clearly and to emphasize the mucosal pattern.

When a small amount of the barium mixture is administered, it passes along the lesser curvature in such a manner that this region has been termed the gastric pathway, and trickles into the by-ways of the crinkled rugae along the greater curvature. Eventually the remainder of the paste is deposited in the antrum; some, perhaps, passes into the cap. This method of distribution depends upon the normal gastric motor phenomenon. Most observers have the patient assume various postures so that the mixture may flow into the furrows with the aid of gravity. Some observers, with more or less success, have attempted to assist Nature by spreading or smearing the barium paste over the surface of the mucosa by using deep manual massage of the abdominal wall, either with or without fluoroscopic control.

Distribution of the Opaque Salt by Sedimentation.—This method was originally employed by the author when he attempted to develop the special mucosal technic previously mentioned. This is accomplished by administering through a drinking tube to a patient in the prone posture, on a flat table, about 1 gram of bismuth subnitrate or bismuth subcarbonate in 4 oz of water. This amount of solution moderately distends the stomach. In from fifteen to twenty minutes the bismuth settles or gravitates onto the furrows between the mucosal folds of the anterior gastric wall. If the correct amount of bismuth has been used, it just fills the furrows between the rugae and the results illustrated in Figures 7 and 8 are obtained. If too large an amount of bismuth is used in 4 oz of water, the furrows are more than filled and the mucosal folds are covered, so that the results are unsatisfactory. A modification of this method is to fill the stomach more completely with a watery solution of 1 gram of bismuth to 8 oz (120 c.c.) of water. With this larger amount of water, the mucosal folds are smoothed out so that the bismuth settles onto a relatively smooth surface. Then, as the water is drawn off by means of a small tube, the stomach diminishes in size, the mucosa is thrown into folds, and the bismuth becomes incarcerated within the furrows between the folds. We have found that the sedimentation of the bismuth is accelerated if the required amount of dry bismuth is placed on the tongue and then washed down with the 4 or 8 oz of water.

A preliminary washing out of the stomach with an alkaline solution, in order to dissolve the mucus, makes this method even more satisfactory. The mucosa of the posterior gastric wall may be likewise demonstrated by placing the patient in the supine posture.

secondary rays His device employs compression in the following manner Between the fluoroscope or film and the patient he causes pressure to be exerted on the abdomen, which is soft and compressible, rather than on the patient's back, where the ribs and spine render it practically incompressible This procedure is not new To it, however, Åkerlund added a revolving grid located in the end of the cylinder that is pressed against the patient For the perfection of this he deserves great credit By the use of this apparatus, one diminishes the detrimental effects of the secondary rays that are generated in a relatively large region However, the revolving grid that increases the brilliancy of the roentgenogram, as does any other grid, likewise adds to the time of exposure and likewise adds the disagreeable grid characteristics, while its large size prevents local application of pressure Some of the prominent observers who previously used this apparatus, realizing that the smaller the area of observation, the less valuable the grid, discontinued its use This method, although employing two of the five methods of diminishing the detrimental effects of secondary radiation, namely, compression and the grid, does not utilize the other three, that is, the tube, the cone, and the close apposition of the film to the opaque medium

Berg employs a method similar to Åkerlund's, but without the revolving grid Of the five methods of diminishing the detrimental effects of secondary rays, Berg depends chiefly on compression applied to the abdomen by a cylinder or cone mounted on the back of the fluoroscopic screen In doing this he has exaggerated *reversely* the fifth principle by placing the film away from the patient Berg, with this apparatus under fluoroscopic control, is able to exert any desired pressure on the stomach or cap, displacing the bulk of the barium mixture and leaving only that which is caught in the furrows between the mucosal folds He is enabled thus to make a thorough fluoroscopic exploration of the gastric mucosa When any interesting area is observed fluoroscopically a film is substituted for the screen and a radiographic record is made In this procedure only one method of obviating the detrimental effects of secondary rays is employed, namely, compression By this method Berg gets a gross elimination of the widely scattered secondary rays, and he speaks of the Bucky effect of the cylinder A close scrutiny of the illustrations appearing in Berg's book indicates that his most brilliant roentgenographs are those in which his special compression apparatus has not been used

It should be noted that in both Åkerlund's and Berg's compression cylinders the fluoroscopic screen or film is inserted at the end of the cylinder and is at a very considerable distance from the patient, therefore, the screen and film are not in close apposition to the region being examined In Åkerlund's device the film is separated from the patient by the thickness of the grid and the housing over the grid The fifth principle—close apposition of the fluoroscopic screen or film to the part being examined—which is perhaps the most important of the five principles for eliminating secondary radiation, is em-

(+) APPLICATION OF THE X-RAYS

Roentgenograms may include an entire region, such as stomach, cap, and duodenum, or they may be limited to small localized areas three or four inches in diameter. Films of an entire region may be made with or without a grid. Those made with a grid are more brilliant, but because of the increased length of time required for exposure, and other unsatisfactory grid characteristics, they are less diagnostic than the roentgenograms made without the grid and with the use of a cone of just sufficient size to include the stomach, cap, and duodenum. A thorough consideration of this subject would in itself require a book. We shall, therefore, mention only the salient principles.

Secondary radiation is the bane of the roentgenologist's existence—particularly true in regard to the gastro-intestinal tract. Five factors have been employed to prevent the development of secondary rays or to obviate their detrimental effect: (1) The gas tube, (2) the cone, (3) compression, (4) the grid, and (5) the close apposition of the film to the opaque medium.

The gas tube generates fewer secondary rays per cubic space radiated than any other tube because of the fact that the indirect rays generated in the gas tube are of very low penetration and are easily eliminated by the cone.

The cone is one of the oldest and is perhaps the most important device for obviating secondary radiation. It utilizes the principle of diminishing the surface area of the region that is being exposed. The smaller the cone, the smaller the surface area (or cubic space) radiated, consequently, the less the secondary radiation, the more brilliant the roentgenogram.

Compression is used to diminish the thickness of the part being exposed. When combined with the cone it diminishes to a minimum size the cubic space exposed to the X-ray. The smaller the cubic space radiated, the less is the secondary radiation. Compression also diminishes the time required for exposure. Compression may be applied either between the tube and the patient's back, or to the patient's abdomen, as will be described later.

The grid tends to eliminate secondary radiation. The larger the area that is exposed to radiation, the more valuable is the grid. Conversely, the smaller the area, the less valuable is the grid. The grid has its advantages and its disadvantages. It increases the time of the exposure twofold or threefold, thus allowing the motion due to peristalsis to become a detrimental factor. It increases also the distance of the film from the patient, causing distortion.

Close apposition of the film to the region under observation not only lessens the amount of secondary radiation, but is an application of the following law of optics, "the nearer an object is to a screen or film, the clearer and more distinct is its shadow."

One or more of these principles to minimize the effect of secondary radiation are applied by the various observers, especially by those who have constructed their own apparatus. The ingenious apparatus designed by Åkerlund utilizes two of these five principles for obviating the detrimental effects of

roentgenographed. By using this apparatus only a very small area is exposed and so the grid would be of little or no value, and actually detrimental.

The fifth principle, that is, close apposition of the film or screen to the part being examined, is employed, bringing about not only a diminution of the secondary rays generated between the stomach and the film, but also a more brilliant and clear-cut image in accordance with the optical law, "the nearer the film to the object, the sharper the shadow."

Pressure.—As regards the roentgenological examination of the gastro-intestinal tract, compression and pressure are entirely different, at least, we shall so regard them. Compression is applied to diminish the thickness of the part and so reduce its secondary rays. Pressure is employed to displace the bulk of the opaque medium (barium) from the lumen of the gut and to accentuate the mucosal pattern. Pressure is usually applied to small areas as by Åkerlund and Berg, although Chaoul applies pressure to larger areas by means of a large, inflatable, flat rubber bag which is strapped to the abdomen. We use both, as is shown in our illustrations. Pressure as applied by Åkerlund and by Berg is usually under fluoroscopic control, that is, the operator personally views the region fluoroscopically. When he sees some finding which is of interest he substitutes a film for the screen and makes a small roentgenograph for a permanent record. While he is making this roentgenograph he can personally orient himself and determine the exact region that is being examined. However, if the small films, especially those of the stomach, were to be observed without a knowledge of the exact region in which they were made, as observed fluoroscopically, it would be difficult to identify the region.

Pressure gives a different set of findings for a criterion on which to base radiographic diagnosis, and undoubtedly it allows a more comprehensive study of the mucosal folds and the surface of the mucosa. In our own experience and by an intensive study of the illustrations submitted by others, we find that there are very few instances in which the diagnosis of an organic lesion has been established by pressure in cases in which it has not been established by radiographs made without pressure.

The manner in which the rugae of the stomach diverge as they approach certain types of carcinomatous growths or the manner in which they converge toward the crater of an ulcer at a certain late stage in its process of repair, are findings of scientific interest. They do not, however, alter the diagnosis as established by the routine method without pressure. It must be remembered that visualization of rugae and application of pressure are not synonymous. Indeed, it is often more difficult to determine the size and shape of the crater of an ulcer when the barium is displaced by pressure than it is when the crater is filled by moderate distention of the stomach without pressure.

External pressure.—whether achieved with Åkerlund's rotary grid, the cylinder used by Berg, a rubber bag strapped to the abdomen as recommended by Chaoul, or with our own apparatus constructed by Headland—has both

ployed by neither Skerlund nor Berg, and the detrimental effects are exaggerated by both of their methods.

Bearing in mind the five factors enumerated as aids to the diminution of the detrimental effects of secondary radiation, one of us (C I H), at the essayist's suggestion, has designed and constructed a device for examining fluoroscopically and roentgenographically small localized areas of the gastrointestinal tract, particularly the stomach and cap (Figs. 16 and 17). The principles employed in this apparatus are as follows:

(1) An X-ray tube is used that generates fewer secondary rays in the patient than any other tube, namely, the gas tube.

(2) A cone is used which has the smallest diameter that will cover a $3\frac{1}{4} \times 4$ inch film at a 24-inch distance.

(3) Compression is exerted on the soft, compressible abdomen by a rectangular piston which has rounded corners. No compression is exerted by the small cone attached to the tube holder.

(4) No grid is used.

(5) The device is so arranged that the intensifying screens and fluoroscopic screen are located at the end of the piston which is pressed into the abdomen. Thus, with pressure, the film and screens are embedded well within the normal contour of the abdomen and in close contact to the opaque medium.

With this device we not only see the exact image which we desire to radiograph prior to the rapid insertion of the film, but we also see the actual fluoroscopic image recorded on the film.

An old-fashioned gas tube is employed because this is the only tube in which indirect rays are not generated on the back of the target. The elimination of indirect rays from the back of the target diminishes the quantity and penetration of the secondary rays generated in the patient. The gas tube is the only tube used for roentgenographic work in the institutions with which I am associated, except in connection with portable and dental apparatus.

The second principle involved in our device for eliminating secondary radiation is the limitation to a minimum size of the surface area exposed to the rays. This principle is accomplished by employing the oldest of all methods for obviating secondary radiation, namely, a cone of such small diameter that it barely covers a $3\frac{1}{4} \times 4$ inch film at a 24-inch distance.

The third principle, namely compression, is applied to the soft parts of the abdomen which are compressible, and in this manner the distance between the film and the posterior surface of the patient is reduced to a minimum. Secondary rays are developed in proportion to the cubic space that is radiated; therefore with a cone of minimum size and with the desired maximum amount of compression, the cubic space radiated is reduced to a minimum. Thus the quantity of secondary rays generated is reduced to a minimum.

The fourth principle, namely the grid, is not used because, as we have stated previously, the grid is chiefly of value when large areas are to be

its advantages and disadvantages as a method of showing or exaggerating the pattern of the mucosal folds. It is a moot question whether or not it should be used. Some observers depend very largely on gradation or dosage of external pressure to displace the bulk of a small opaque meal from a local region so that the mucosal pattern of local regions may be observed fluoroscopically or roentgenographically. Small roentgenographs made with various devices show more contrast than roentgenographs of full size, but with the grid interposed or with the film at the end of the cylinder away from the patient, detail is diminished and distortion results. Even when one is able to obtain small roentgenographs with great brilliancy and without loss of detail there is still much question in my mind as to whether the findings aid or hinder in the diagnosis of gastro-intestinal lesions. Although numerous articles have been illustrated by brilliant, localized roentgenographs, very few observers have recorded any systematic comparison of these small local films obtained by pressure, with routine roentgenographic examinations, serial or otherwise.

We have run quite a large series of cases, making twelve small roentgenographs of the cap with varying degrees of pressure (Figs. 18 and 19), in addition to the routine serial roentgenographic examination. By comparing the findings of the cap, as observed by both methods, we have come to the following conclusions:

Whereas small roentgenographs are much more economical, they are limited to a small region and difficult to orient, except in the cap. The small films of the stomach are almost valueless inasmuch as they cannot be oriented except by comparison with a large film which shows nearly as much detail. The small films furnish brilliant contrasts and are fascinatingly interesting to study, especially with the old-fashioned hand stereoscope to which these $3\frac{1}{4} \times 4$ inch films are so well adapted. Nevertheless, we have yet to find a case in which the small films, made with varying degrees of pressure, have caused us to alter the diagnosis as based on serial films of full size made without pressure. Pressure interferes, in many instances, with the manner in which a normal or pathological cap behaves when it receives a squirt of barium through the pyloric valve, or when its distal two-thirds are evacuated by a broad peristaltic wave. A cap under abnormal external pressure does not act normally in response to the gastric motor phenomenon. Thus external pressure employed to exaggerate the mucosal pattern becomes a two-edged sword with which, I fear, many will cut their fingers!

(To be continued)

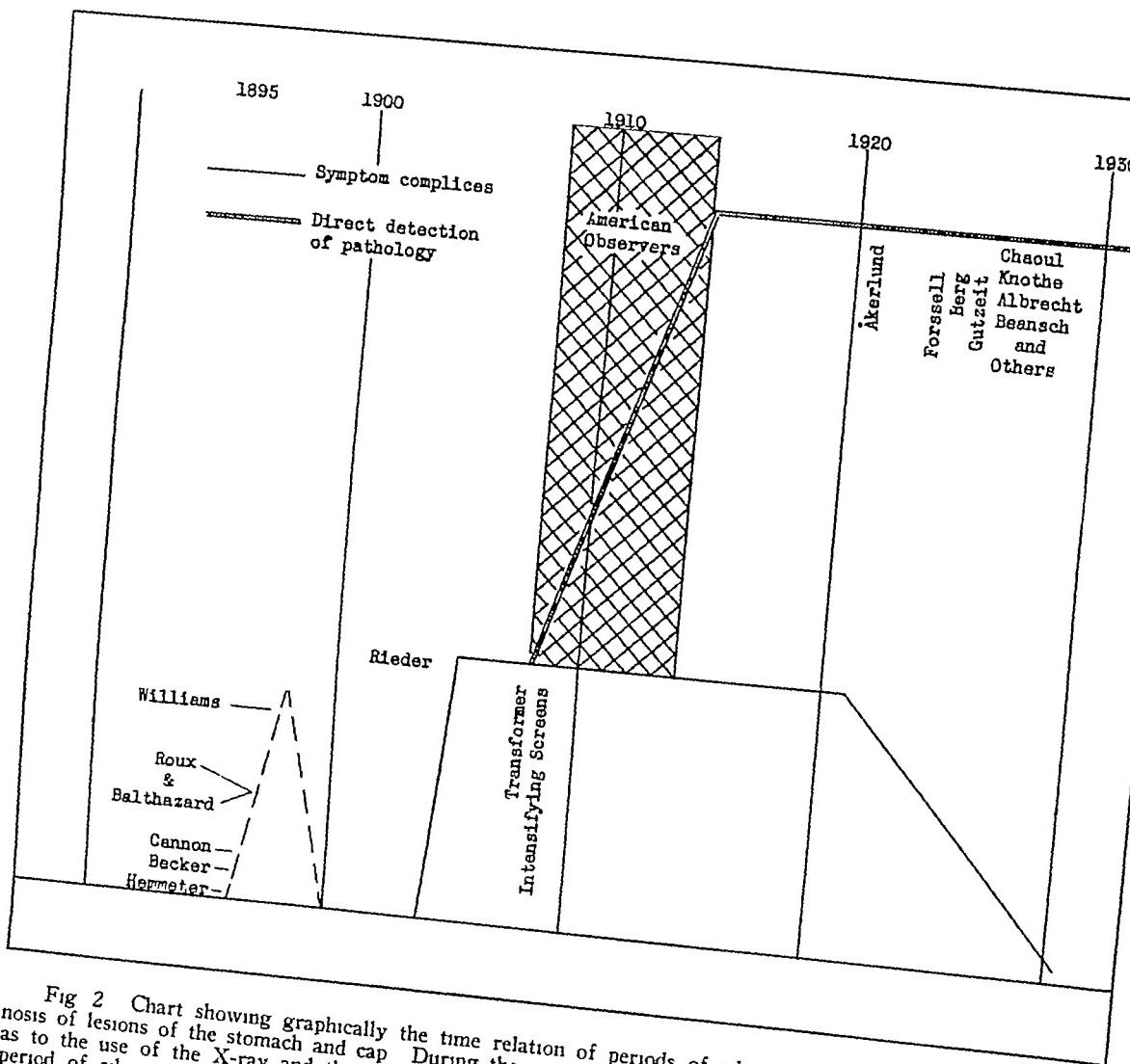
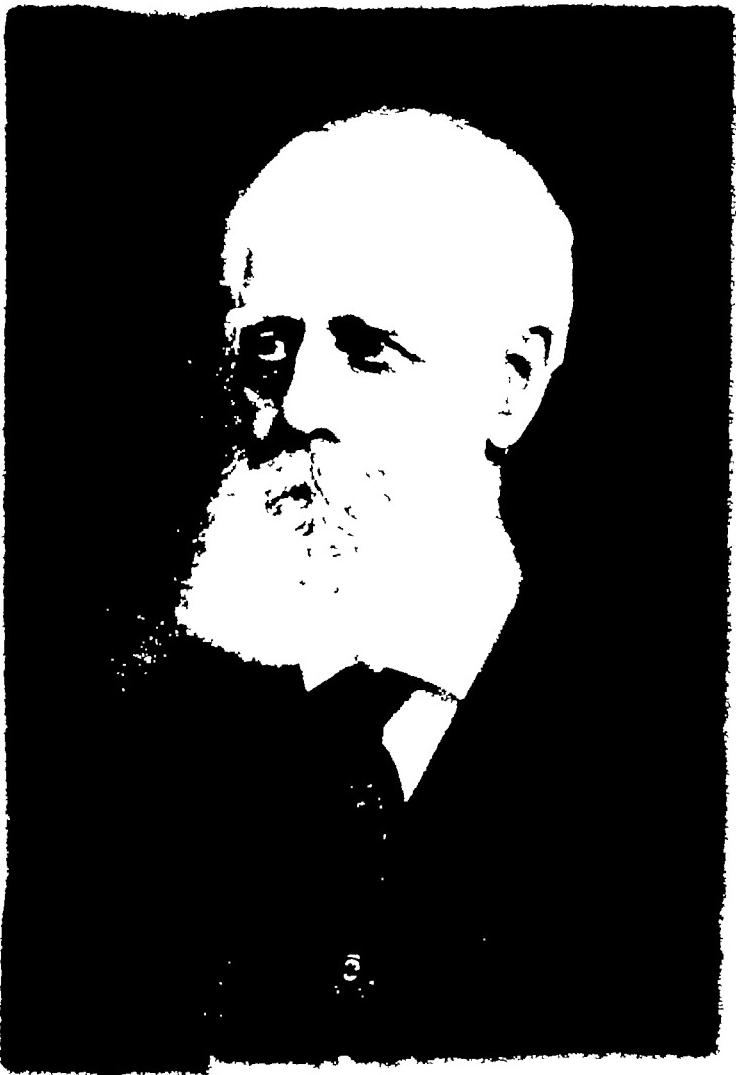


Fig 2 Chart showing graphically the time relation of periods of advance in the roentgenological diagnosis of lesions of the stomach and cap. During the period between 1896 and 1900 observations were made as to the use of the X-ray and the opaque meal for making visible the stomach. From 1900 to 1904 was a period of silence. Rieder's work in 1904 resurrected the use of the X-rays for study of the gastro-intestinal tract, and for the first time roentgenologic examination was used for diagnosis, the criterion for diagnosis of pathologic lesions being the so-called "symptom complices". Satisfactory roentgenography of the stomach was possible only after the introduction of the transformer and intensifying screens in 1908. Roentgenographic examination of the stomach made possible the direct detection of abnormal morphologic changes in the wall of the gut. The period from 1908 to 1914, indicated by the cross-hatched area on the chart, was the "red letter days" of roentgenographic exploration of the gastro-intestinal tract.



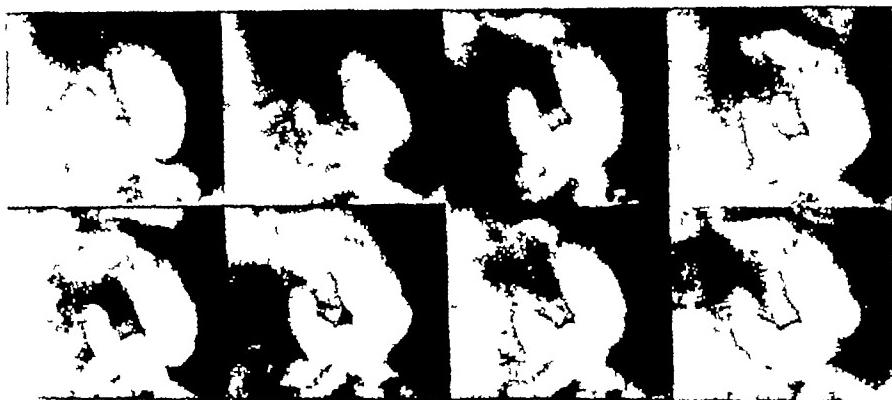
James H. Billam M.D.



Erect



Prone



Prone oblique

Fig 5 Serial roentgenograms of the stomach in the postero-anterior and right oblique directions with the patient prone, and in the postero-anterior direction with the patient erect

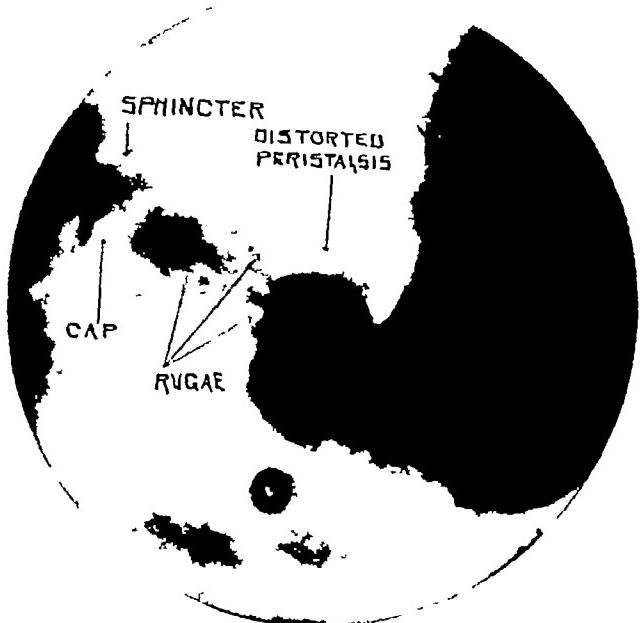


Fig 3 Spasm of the stomach.

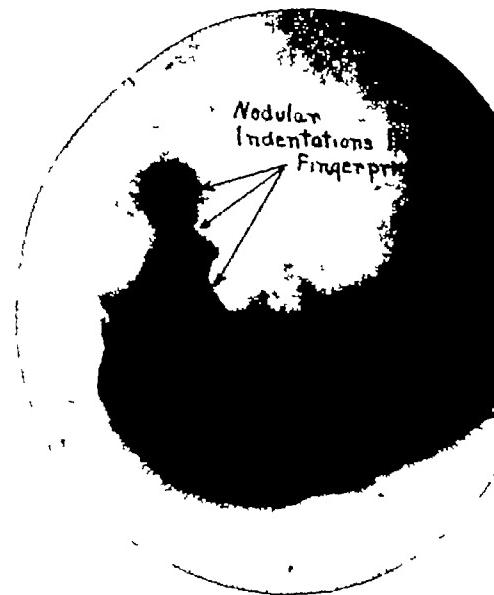


Fig 4 Cancer of the stomach

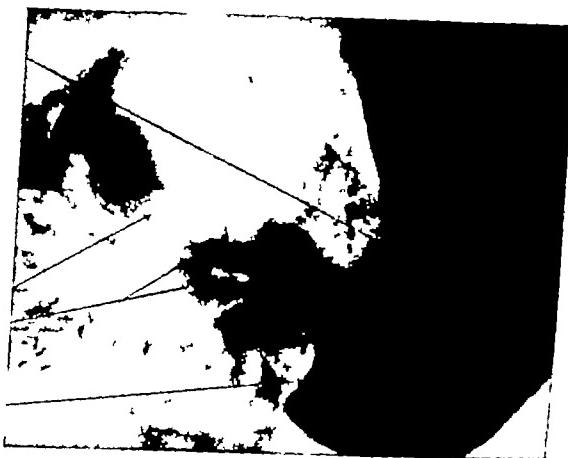


Fig 3' Spasm of the stomach

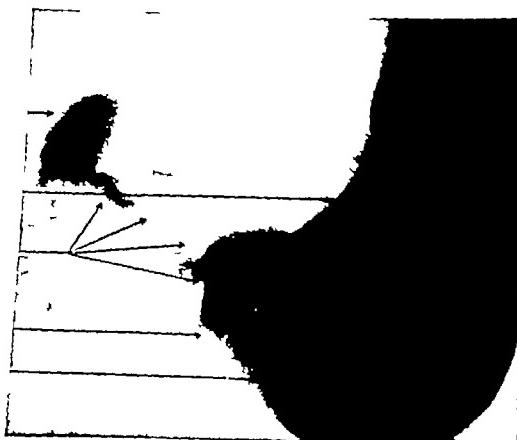


Fig 4' Cancer of the stomach.

The changes shown in the above roentgenograms were designated as filling defects, due either to spasm as shown in Figures 3 and 3 prime, where the rugæ are observed more distinctly than usual, or to a cancer protruding into the lumen of the stomach as shown in Figures 4 and 4 prime where the rugæ in the involved area are completely obliterated. These figures illustrated an article originally published in 1912, and these reproductions are made from the same photo-engraved blocks.



Fig 7 Patient, Mr S, Oct 13, 1910 This roentgenogram was the essayist's first intentional attempt to demonstrate the pattern of the gastric mucosa by a special technic. The patient ingested a suspension of one gram of bismuth subnitrate in four ounces of water, and was placed in the prone posture for twenty minutes, the heavy bismuth settling out of suspension onto the mucosal folds of the stomach



Fig 6 Roentgenograms showing the passage of the barium meal through the small and large intestine, and examination of the colon after administration of the opaque enema and after its evacuation indicate, together with Figure 5, what the essayist originally designated as serial roentgenography of the gastro-intestinal tract



Fig 7 Patient, Mr S, Oct 13, 1910 This roentgenogram was the essayist's first intentional attempt to demonstrate the pattern of the gastric mucosa by a special technic. The patient ingested a suspension of one gram of bismuth subnitrate in four ounces of water, and was placed in the prone posture for twenty minutes, the heavy bismuth settling out of suspension onto the furrows between the mucosal folds of the stomach



Fig 8 Serial roentgenography, *i.e.*, multiple roentgenograms of the stomach in combination with the special mucosal technic as illustrated in Figure 7, shows the constancy of position of the mucosal folds except as they are disturbed by the progressive peristaltic contractions

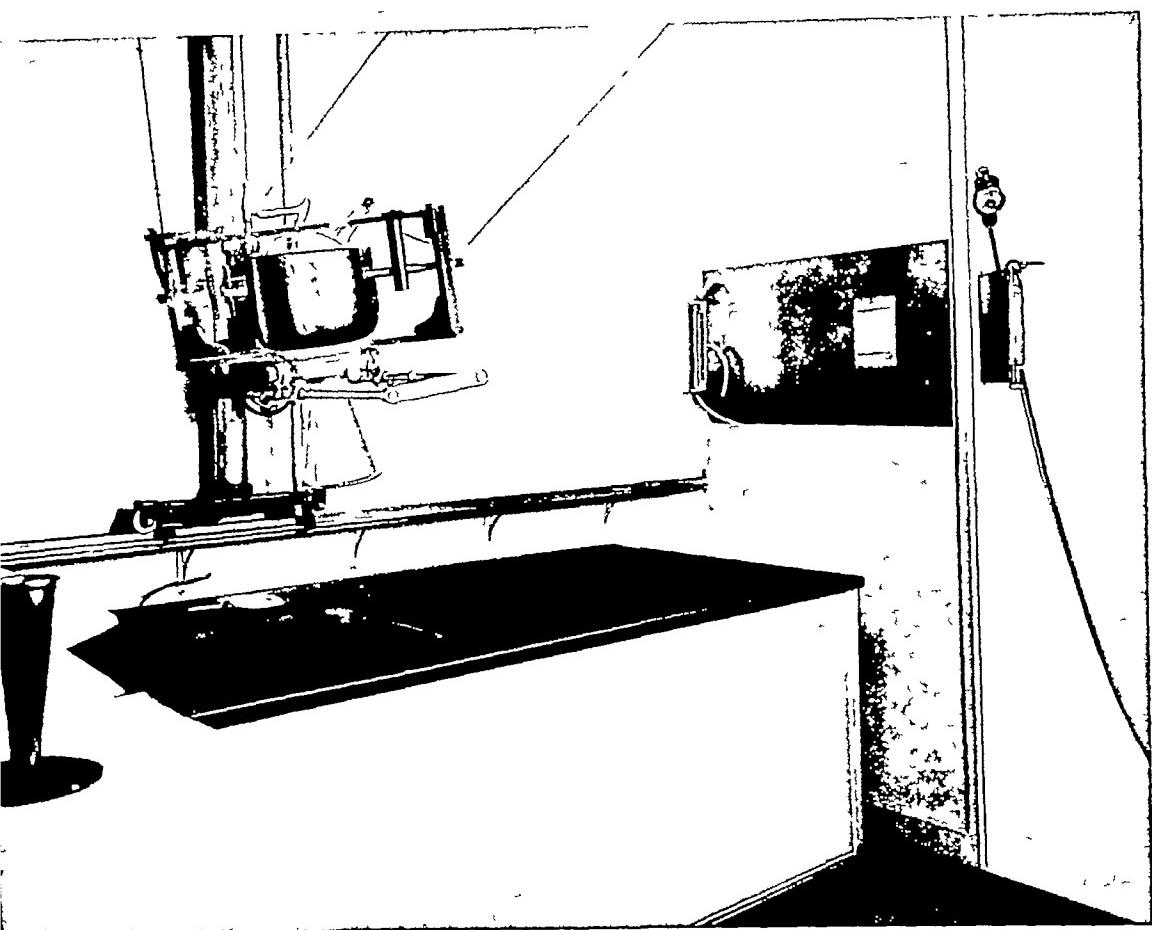


Fig 9 Serial table, built as an emergency table just after the fire in 1924, since which time it has been in constant use. This table is a box 40 inches high, 36 inches wide, and 7 feet long, built into a wall concealing a dark operating booth. The bakelite panel in the top of the table is the top of the film-changing device shown in detail in the cross-sectional drawing (Figure 10).

The bakelite panel in the wall at the end of the table conceals the film-changing apparatus for making serial roentgenograms of the patient in the erect posture. This film-changing apparatus is a cassette built into the wall, entirely similar to the erect film-changing apparatus shown in the Model Table designed and constructed by Headland (Figure 10). The back of the cassette is made of bakelite, and carries the back intensifying screen in front and a fluoroscopic screen behind. The fluoroscopic screen is covered with lead glass. The patient is held tightly in position by the belt shown in the picture. The holders of the belt are offset from the wall so that the angle of the belt is not acute and will not slip easily. The holder on the right side, which contains the ratchet gear, is mounted on hinges, so that it may be swung back out of the way into the position shown in the photograph.

The compression device designed and constructed by Headland can be seen partially protruding through the bakelite panel in the end wall. The detailed construction of this is shown in Figures 16 and 17. The small cone on the table in the foreground is used when we make the small compression roentgenograms and will just cover a $3\frac{1}{4} \times 4$ inch film at a 24-inch distance.

The small rubber bag shown lying on the table behind the bakelite panel may be attached to a rubber tube for use with either the prone or erect apparatus. It is used for exerting pressure on relatively large areas of the stomach and colon, and is inflated from the operating booth under fluoroscopic control.

Exposures may be made either from the operating booth or from the room itself, in the latter case by using the hand switch hanging on the wall.

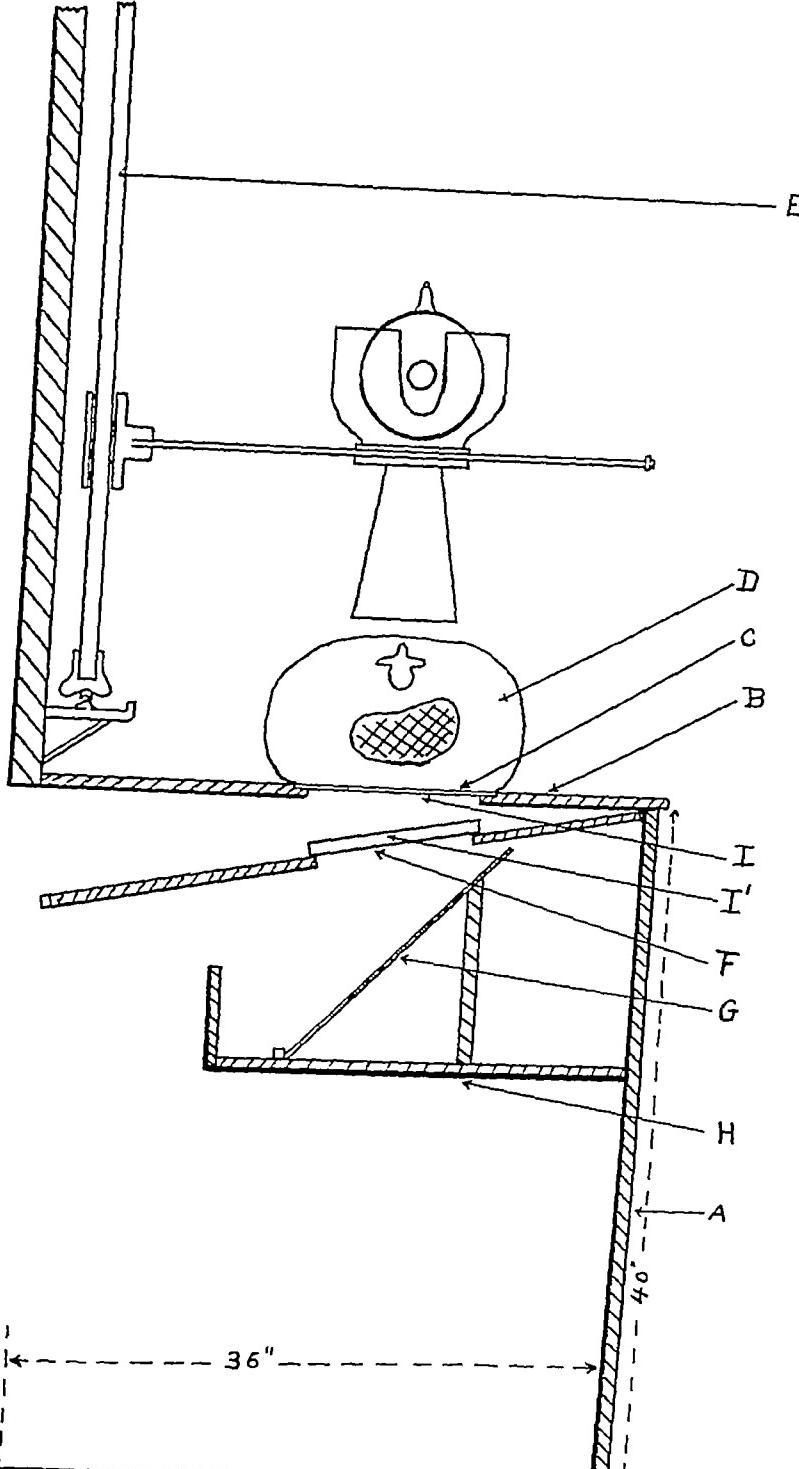


Fig 10 Cross-sectional drawing of the serial table shown in Figure 9. *A*, a wooden box 40 inches high, 36 inches wide, and 7 feet long *B*, wooden top of box *C*, bakelite panel mounted in the top surface of the box *D*, cross-section of patient in the prone posture. *E*, tube stand mounted on rail on the side wall. This mounting of the tube stand is optional, as one may also use a floor tube stand *F*, fluoroscopic screen, surface down *G*, mirror in which to view the fluoroscopic screen *H*, lead-lined box to prevent secondary rays from hitting operator *I*, intensifying screen, surface down. *I'*, intensifying screen surface up *I* and *I'* are for use with naked films when the booth is dark. Any standard cassette may be used in a lighted booth. Only one set of screens is necessary if the booth is dark, otherwise 6 or 8 cassettes with 12 or 16 screens are necessary. The same principle is used for the erect position, with the patient standing at the foot of the table.

The entire table and the exposed wall of the booth is lined with lead, which is indicated by the heavy black line in the drawing

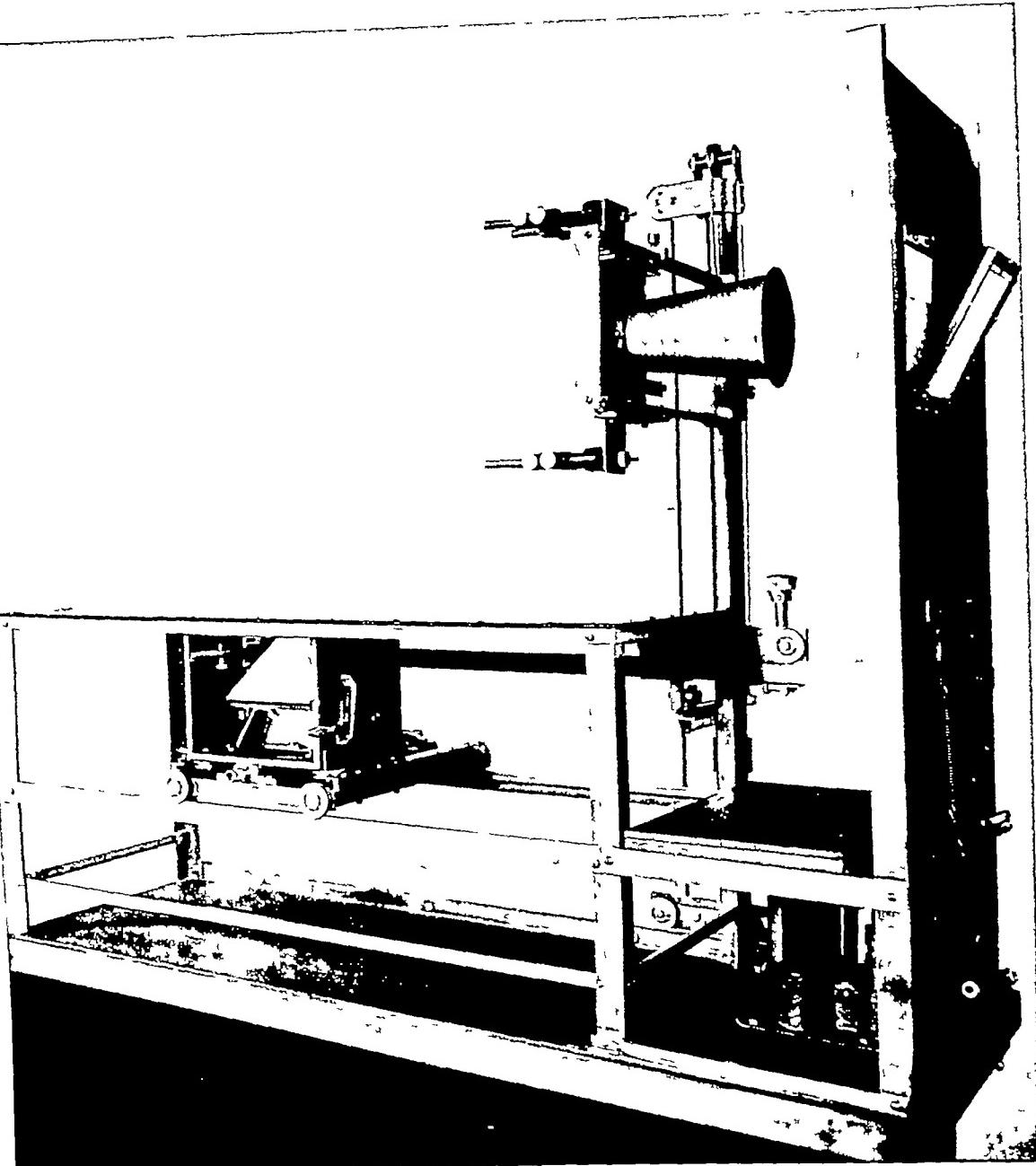


Fig 11. Model of serial table designed and constructed by C I Headland, M.D. This table may be used as it is in a darkened room, or may be mounted as an integral part of the wall of an operator's dark room

In the prone film-changing apparatus the movable hinged shelf which carries above, the lower intensifying screen, and, below, the fluoroscopic screen, is shown hanging down so that the intensifying screen is visible. Below this is the 45-degree angle mirror, and in the mirror one can see the reflected image of the fluoroscopic screen. This box may be interlocked with the tube stand so that the cone automatically is centered to the intensifying and fluoroscopic screens, when the apparatus is moved either up and down or across the table. Thus, by moving the tube stand and film-changing apparatus as a unit, one can localize and center the stomach without moving the patient.

For roentgenography in the erect posture the patient stands upon the platform at the end of the table, facing the lead-lined vertical panel. The platform is mounted on an hydraulic elevator, and the lowering and raising of the elevator is controlled by the two levers which pass through the vertical panel. The film-changing apparatus mounted in the vertical panel is a cassette, the back of which has been replaced by a bakelite cover on the front of which is mounted the back intensifying screen, and on the back of which is mounted the fluoroscopic screen covered with lead glass.

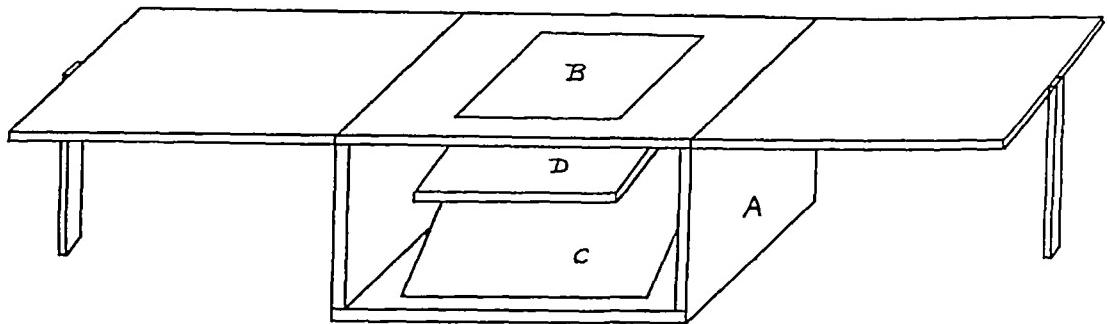


Fig 12 Diagrammatic drawing of the simplest type of apparatus for serial roentgenography. This was primarily constructed and actually used at Base Hospital No 1 4, a flat wooden box *B*, a bakelite panel mounted in the top of the box *C*, a mirror, set at an angle of 45 degrees, to reflect the fluoroscopic image *D*, a wooden shelf attached by hinges to the back side of the box so that it is movable. A fluoroscopic screen is mounted on the under side of this shelf, the fluorescent surface facing the mirror. Cassettes are slid onto the top of the shelf, so that when the shelf is held up against the top, either by the hand or a locking device, the cassette is pressed firmly against the under surface of the bakelite panel. At both ends of the box are leaves of wood to support the patient's body. These leaves are not quite as long as the box and may be so hinged that when not in use the leaves may be folded back on the top of the box, and the entire apparatus may then be used as a step or stool.

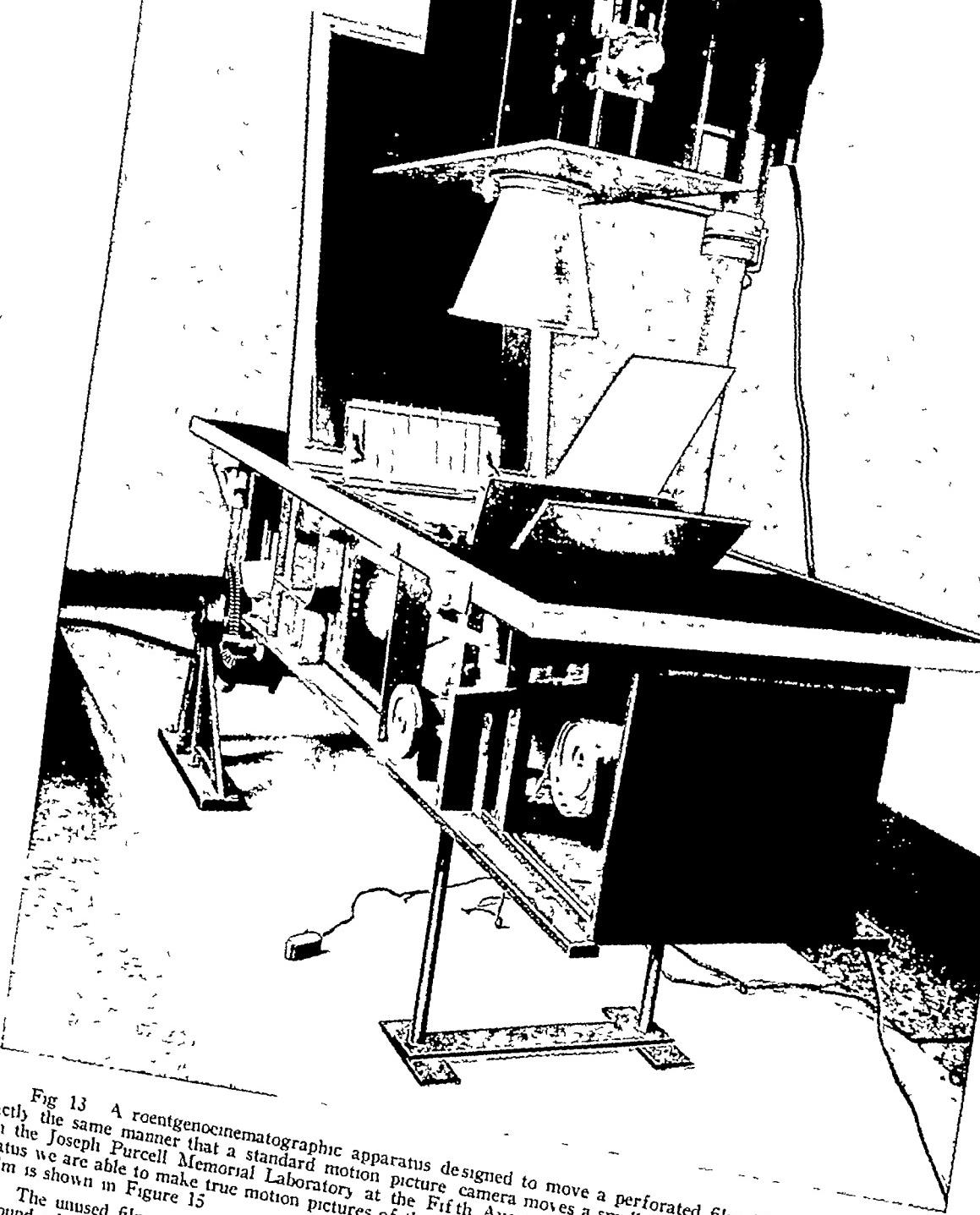


Fig 13. A roentgenocinematographic apparatus designed to move a perforated film 10 inches wide in exactly the same manner that a standard motion picture camera moves a smaller film. This apparatus is installed in the Joseph Purcell Memorial Laboratory at the Fifth Avenue Hospital, New York City. With this apparatus we are able to make true motion pictures of the stomach and a short run of a roentgenocinematographic film is shown in Figure 15.

The unused film is contained in a magazine and is shown under the near end of the table. After passing around wheels with sprockets the film is threaded between intensifying screens and then through rollers back into another magazine at the far end of the table. In this photograph the apparatus is opened up for threading, and when the doors of the apparatus and the table top are closed it appears as is shown in Figure 14. A worm gear at the far end of the table enables it to be used in either the horizontal or vertical position or at any desired angle. The same reflecting mirror which has been employed on the serial tables, enables one to observe the action of the stomach both prior to the making of the film and during the time that the film is actually being exposed.

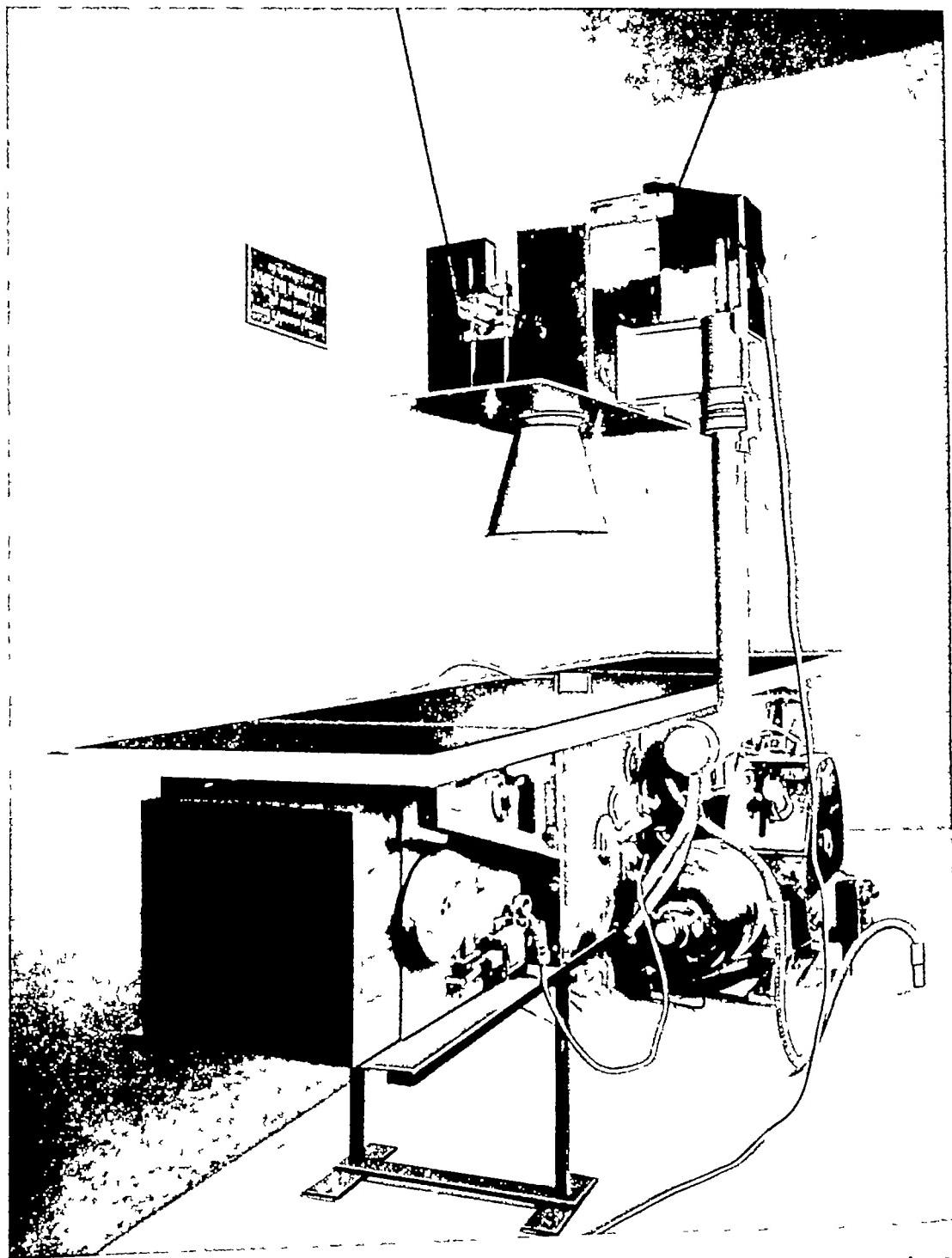


Fig. 14. The roentgenocinematographic apparatus closed and ready for action. The tube is enclosed in a ray-proof box. The timing of the exposures is accomplished by a switch at the top of the tube stand which may be used to break either the secondary or primary current. The motor which drives the mechanical parts is observed in the foreground, and just behind this is a speed-changing device similar in size and shape to a gear shift on an automobile, which enables us to make a continuous roentgenographic film at various rates of speed.

NITRATE FILM
PANCHROMATIC

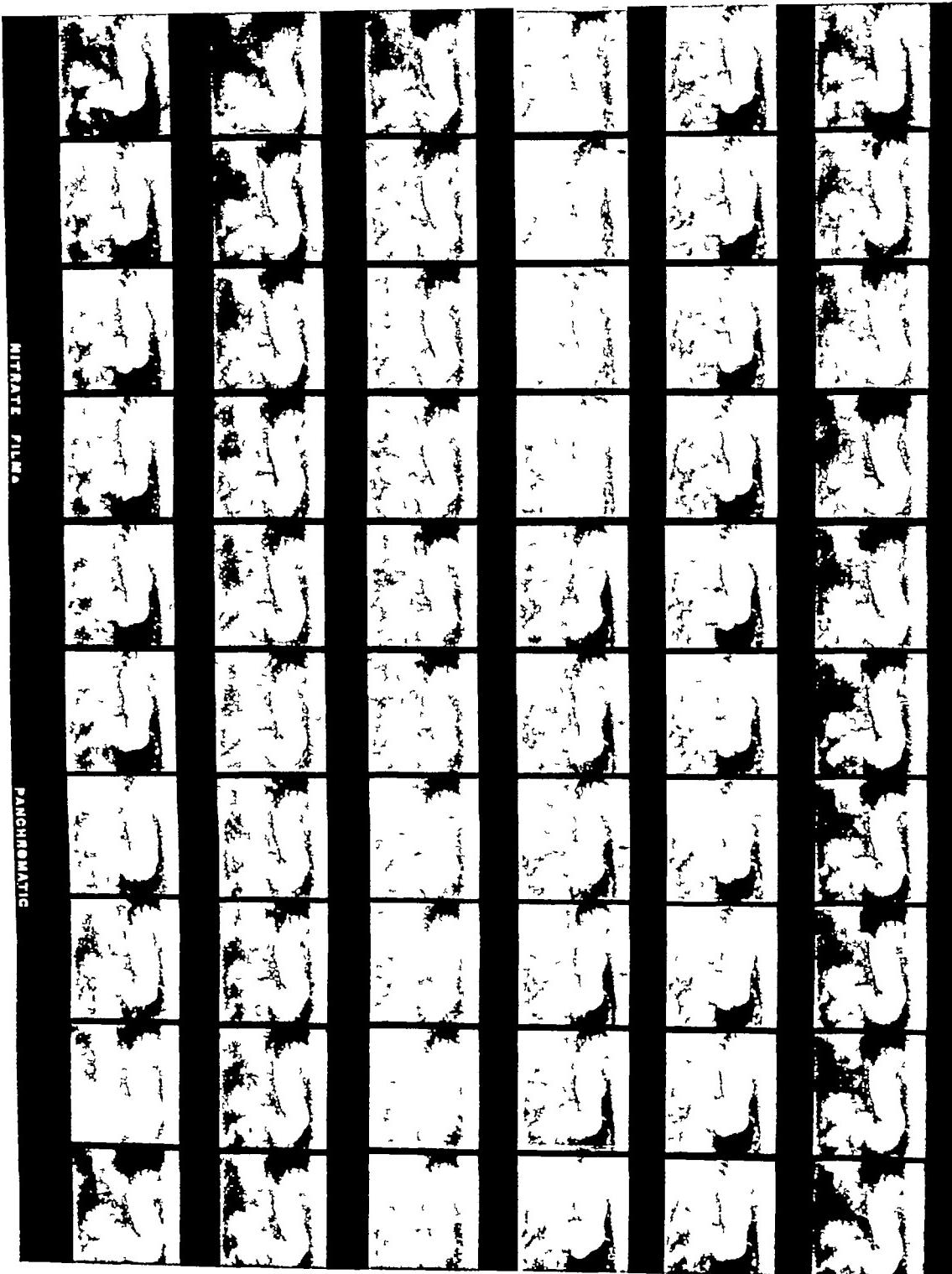


Fig 15 Shows a short run of roentgenocinematographic film of the stomach made with the apparatus illustrated in Figures 13 and 14

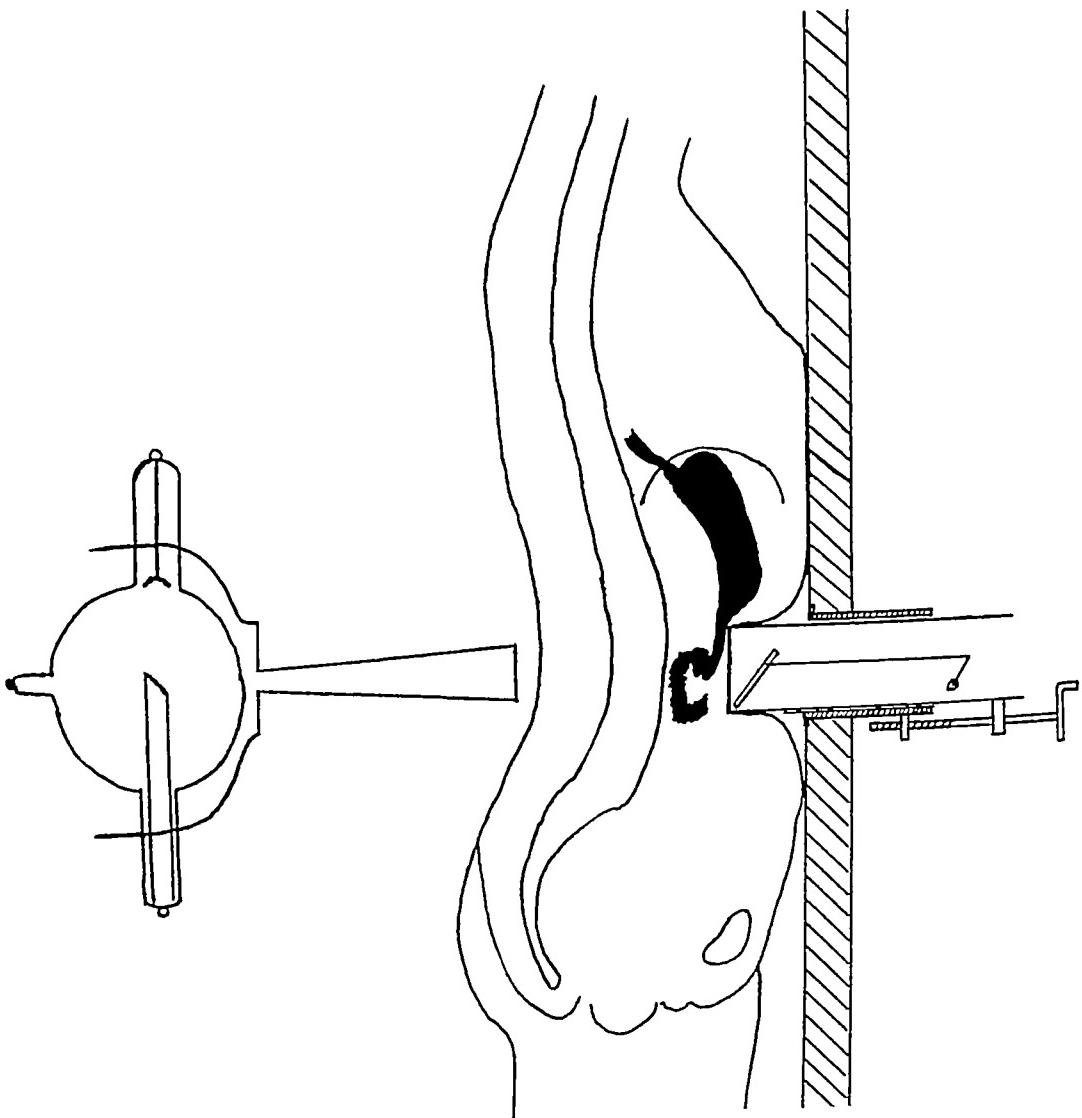


Fig 16 Diagrammatic drawing showing the method of use of the compression apparatus designed and constructed by C I Headland, M D. The patient is held against the face of the wall by the strap shown in Figure 9. This figure also shows the face of the apparatus protruding through the wall.

Compression is exerted on the soft, compressible abdomen by a rectangular piston which has rounded corners and is faced with a beveled layer of cork (third principle). The piston is pressed into the anterior abdominal wall by means of the screw gear. The intensifying screens and the fluoroscopic screen, mounted inside the front of the piston, are thus buried in the anterior abdominal wall and in extremely close contact with the opaque medium (fifth principle). No grid is used, the film being separated from the abdominal wall by only a thin intensifying screen and a thin layer of bakelite and cork. The gas tube is used which generates fewer secondary rays in the patient than any other tube (first principle). A cone is used which has the smallest diameter that will cover a $3\frac{1}{4} \times 4$ inch film at a 24-inch distance (second principle). The region to be examined is localized and the degree of compression desired is obtained under fluoroscopic examination. The image recorded in the roentgenogram is observed fluoroscopically at the instant of exposure.

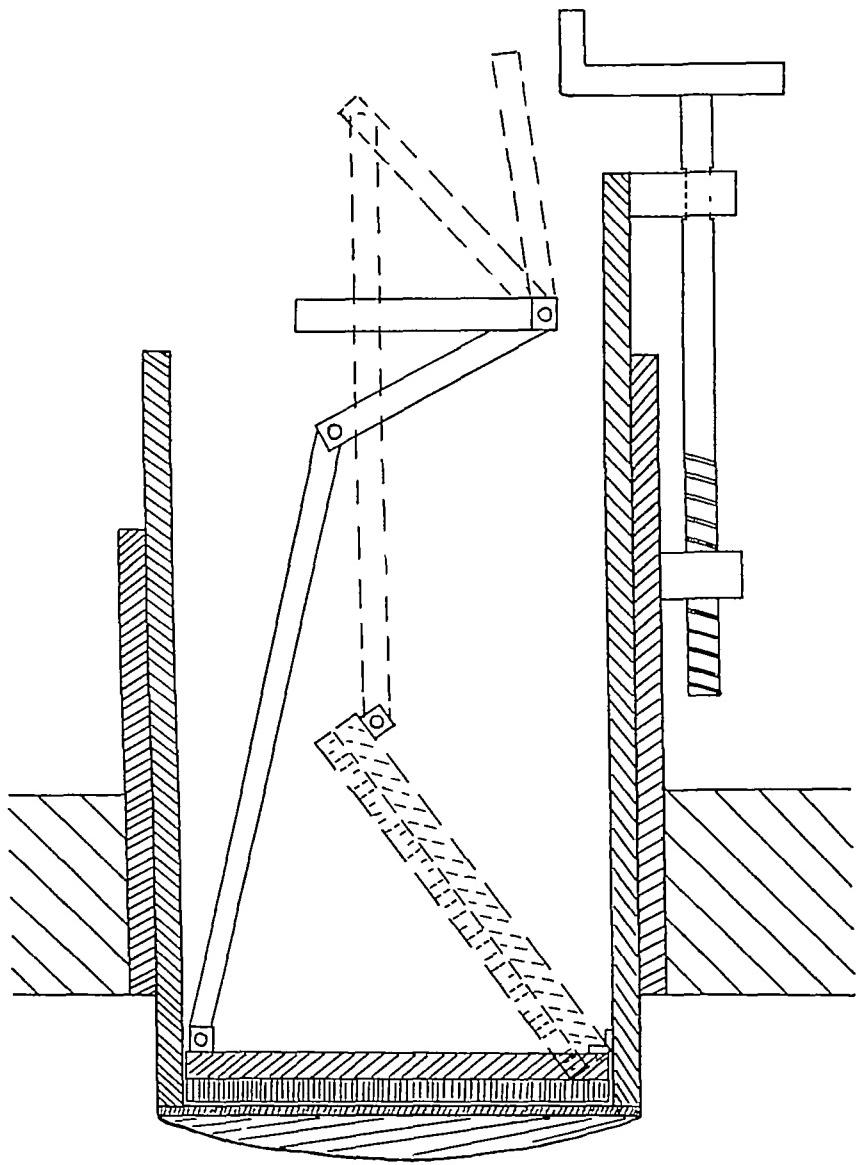


Fig. 17 Diagrammatic cross-sectional drawing showing the plan of construction of the compression device designed by C I Headland, M D. The dotted lines show the position of the movable plate when drawn back for insertion or removal of the film. On this movable plate are mounted the back intensifying screen and the fluoroscopic screen.

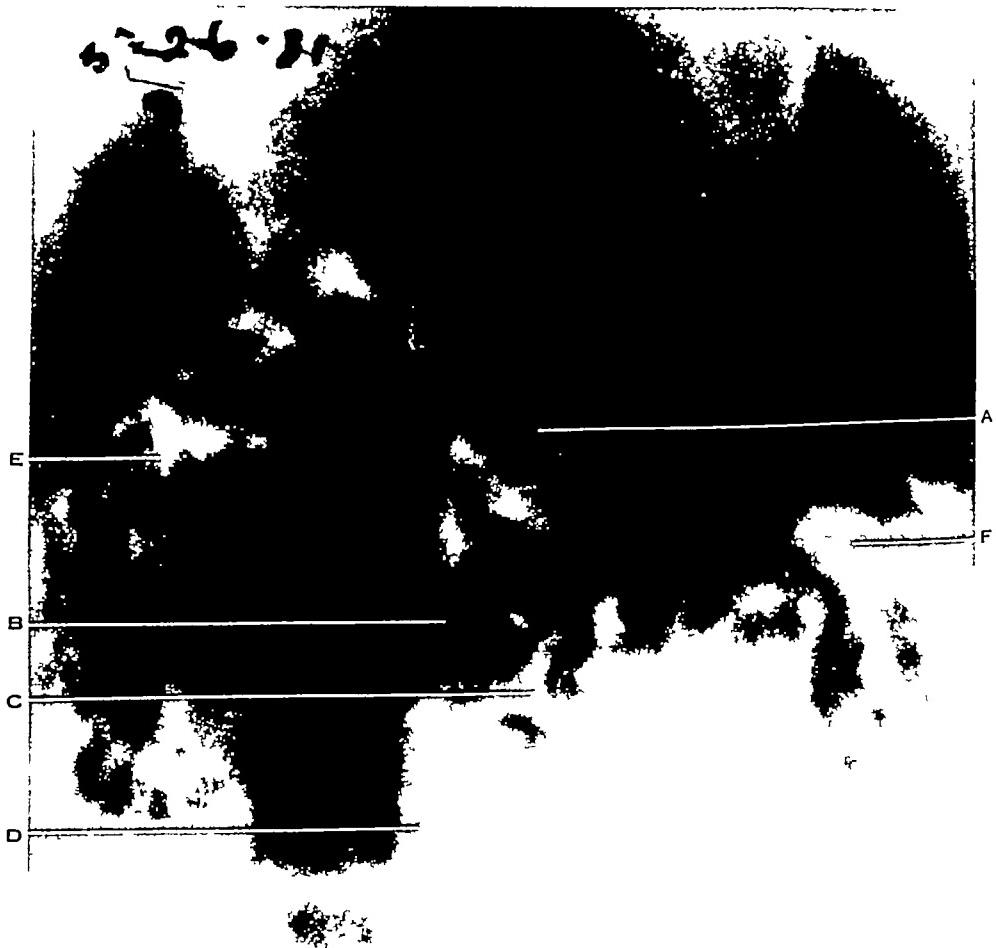


Fig 18 An enlargement of a $3\frac{1}{4} \times 4$ inch film similar to those shown in actual size in Figure 19. This is presented to show the detail and contrast as reproduced on the photo engraving directly from the original film. This detail is obtained by using four out of the five fundamental principles for eliminating secondary radiation described in the text, namely, (1) gas tube, (2) small cone, (3) compression (5) close apposition of the film to the part being examined. The fourth principle, the revolving grid, is not employed.

A, the cap, with criss-cross arrangement of the mucosal folds. B, pyloric valve C, pyloric canal D, antrum E, descending duodenum F, duodenojejunal flexure.

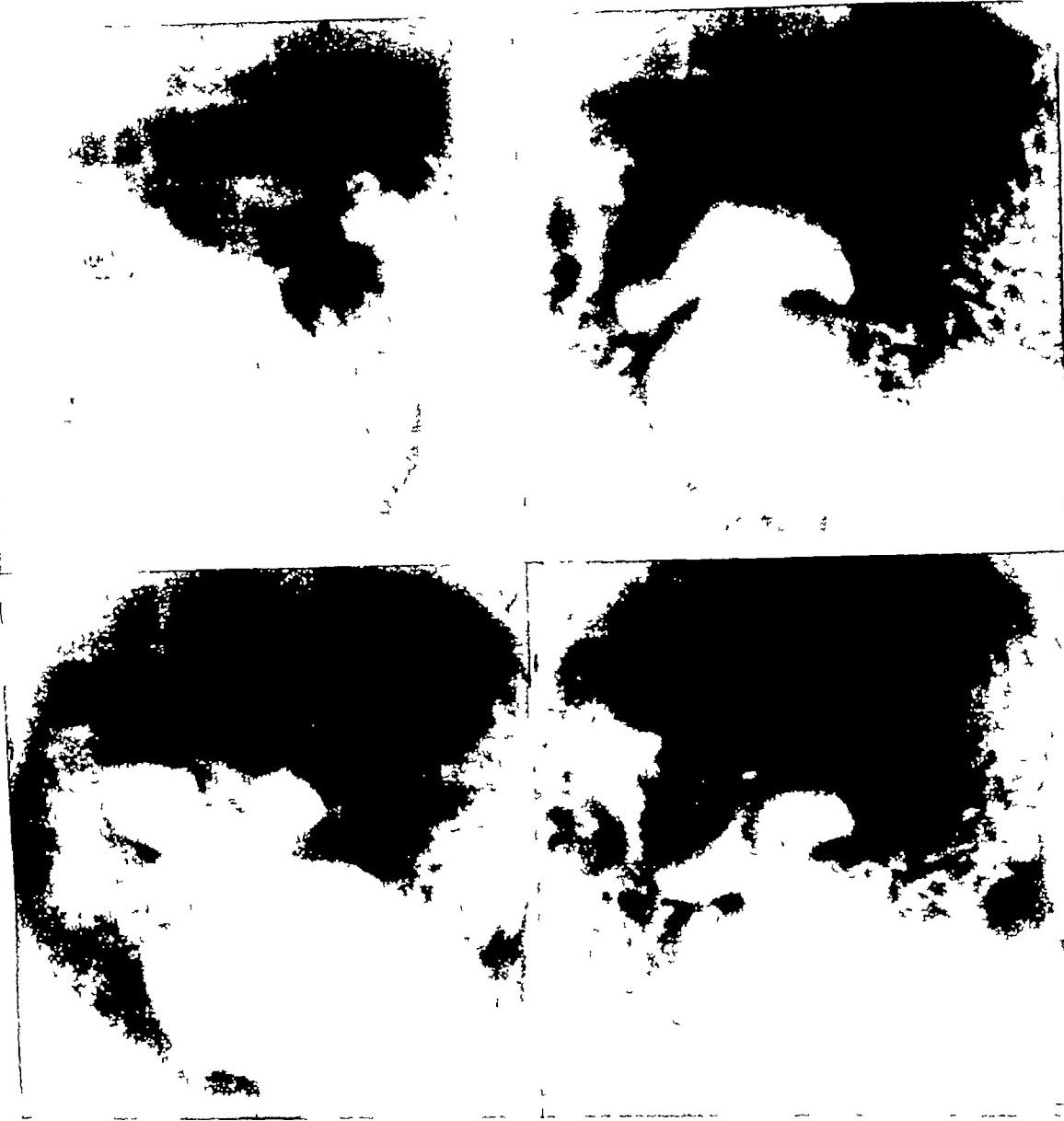


Fig 19 Roentgenograms showing four stages of graduated pressure on the same cap. These are reproduced in actual size directly from the original films. A small ulcer on the posterior surface of the cap is shown distinctly, but it is not as characteristic as the crater deformity shown in the oblique films of the cap without pressure, which will be illustrated later when describing ulcers of the cap.



THE GAMMA RADIATION OF RADIO-ACTIVE SUBSTANCES

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Translation by HENRY BAYON, M.D., New Orleans, La

GAMMA radiation is emitted by a considerable number of radio-active elements which bear a close relationship to X-rays. This very complex radiation constitutes a spectrum of lines, characteristic of the discharging radio-element, the wave lengths of which vary from 0.25 to 0.005 Ångstrom unit. This means that the gamma rays extend the territory of X-rays to high frequencies. Their energies expressed in volts can vary from 50,000 to over two millions.

The power of penetration of these radiations is, in general, far superior to that of

in material substances includes both a classic effect (Thomson) without change of wave length and a Compton effect. The quantum of scattering in this instance assumes an importance which becomes more considerable as the frequency increases, and for radiations, the energy of which corresponds to more than a half-million volts, it is just about the only one observed.

The softest gamma rays exhibit very distinct diffractive effects in crystals, effects which have been utilized in the measurement of their wave length (Rutherford and Andrade, Frille, Thibaud). The author

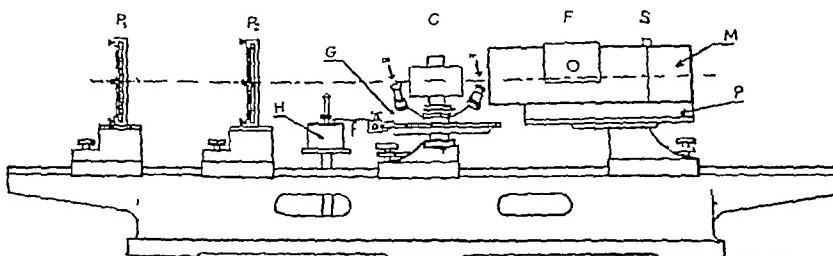


Fig 1 Spectrogram by rotating crystal method for diffraction of gamma rays

X-rays. The effects of certain gamma rays are perceptible through 10, or even 20, cm of lead. Thus, the coefficient of absorption in a lead screen is susceptible of falling to the value $\mu = 0.5$ cm for the very hard gamma rays of Radium C. Moreover, it seems that the law of variation of absorption proportionate to the cube of the wave length (law of Bragg-Pierce) is equally true for gamma radiation.

In general, the X- and gamma-rays exhibit the same properties, modified in the latter, however, by the effect of the extreme shortness of the wave length.

Hence the scattering of the gamma rays

has made use of the rotating crystal method and a spectrograph (Fig 1), which shows the considerable development of the collimating slit system the length of which reaches 25 centimeters. Figure 2 represents the gamma spectrum of the radiothorium. On the right side the rays have energies which do not exceed the energy of X-rays. A weaker line is observed, equal to 0.052 Ångstrom unit, the quantum reaching 236,000 volts.

However, when the frequency rises, the angles of diffraction on usual crystals (rock salt $d = 2.814 \text{ \AA}$) do not extend beyond a few tenths of minutes and measurements of

the wave lengths become altogether inaccurate. Moreover, the intensity of the lines weakens considerably, and the percentage of

tric effect presents here the same aspect as that of roentgen rays the author has verified that for the different elements, from copper to uranium. The kinetic energy of the photo-electric corpuscles is equal to the gamma quantum of the exciting monochromatic gamma radiation, diminished by the energy involved in extraction from the K, L, etc., levels of the element considered (relation of Einstein). In other words, the kinetic energies of photo-electrons coming from the most penetrating gamma rays scarcely differ from the energy of the incident quanta. The experiment is very easily demonstrated by surrounding a tube of small diameter, containing the radio-active substance, by a layer of the element to be investigated, for example, a sheet of lead or platinum. The velocity spectrum of the photo-electrons generated by this secondary radiation is obtained in a magnetic apparatus, similar to the one in use for corpuscular spectra for X-rays, which allows the gathering, at the same point, on a photographic plate of all the secondary beta rays which have been issued from the radiator at the same speed (Fig. 3).

The comparison of beta spectra, registered with different radiations, shows a displacement of all homologous rays towards the greater velocities when the atomic number of the element decreases (Fig. 4). This fact explains the corresponding diminution in the processes of extraction, K or L, of atoms.

These observations have also demonstrated that the spectral lines of beta rays, spontaneously emitted by radio-active substances of gamma radiation, were due to the conversion of the latter in the electronic layers of the radio-active atom.

Examined in a very light element, such as gas, the photo-electrons are relatively scarce compared to recoil Compton electrons. It is known that the relation of the numbers of secondary electrons of each of these types represents, for the radiations of

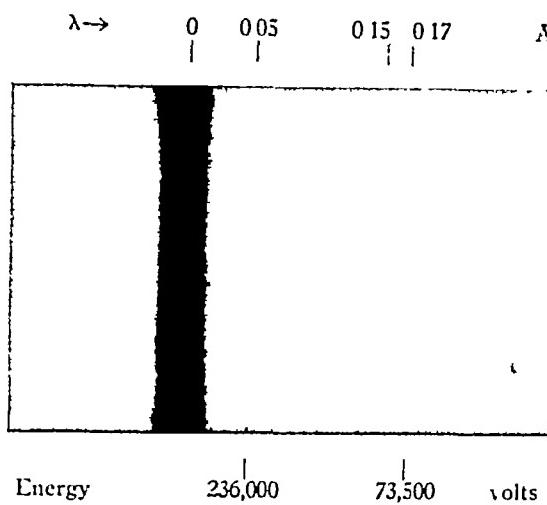


Fig. 2 Spectrum of gamma radiation of a radio-thorium preparation (rotating crystal)

electromagnetic effect in the spherical coefficient of gamma-ray scattering diminishes rapidly when the quantum exceeds 200,000 volts.

On the contrary, the effect of Compton scattering is particularly clear-cut: the recoil electrons acquire considerable speed. Photographed in the Wilson chamber, their trajectories present a rectilinear course, at times exceeding a decimeter, which distinguishes them clearly from the recoil electrons produced by the impact of the X-rays (fish tracks), measuring, at most, a few millimeters. The biologic effects of hard gamma rays must be attributed to these secondary scattered electrons travelling through the irradiated tissues like minute arrows, disseminating in the cells the ions generated on their way.

The gamma rays coming in contact with the tissues give rise to abundant secondary radiations and, particularly to an appreciable corpuscular radiation. The photo-elec-

high frequencies, the relation of coefficient of scattering σ and of absorption due to fluorescence in the radiating element. For

and that there are radiations of still higher quanta¹

Differing from X-rays, gamma radiations

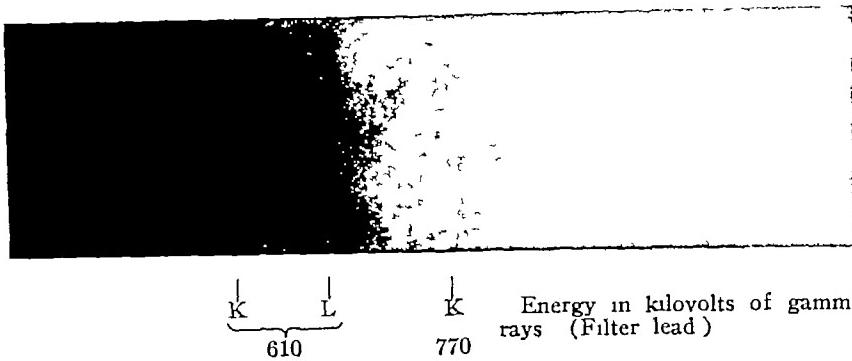


Fig 3 Photo-electric effect of gamma rays of radium

example, the relation of the coefficients σ/τ passes from the value 0.27 to the value 32, when the wave length diminishes from 0.7 to 0.1 Ångstrom unit. It is evident that for gamma rays this ratio can assume high values and that the number of the recoil electrons observed in the Wilson apparatus in a gas is extremely high compared to the photo-electric electrons.

The measurement of the wave lengths of gamma rays by diffraction in crystals is limited, as we have seen, to the less penetrating of these radiations. The most general method consists in determining directly the frequencies, beginning from the photo-electric relation of Einstein, by transforming the gamma spectrum to be considered into secondary electrons in a radiator of well-known levels of energy. In this manner, Ellis and Thibaud have been able to demonstrate the great number of gamma spectral lines in different radio-elements of radium and thorium families. The quantum of some of these radiations exceeds the enormous energy of 2,000,000 volts (wave length 0.006 Ångstrom unit). It is probable that only the inadequacy of our measuring instruments actually imposes this limit

emanate from much deeper atomic regions. Their origin must be attributed to energy exchanges generated in the very nucleus of the atom. Undoubtedly the study of such spectra will result in appreciable information regarding the dynamics of these still mysterious minute nuclei. Their complexity is certainly as great as that of the rest of the atomic structure. It already has been demonstrated in the absence of other guides that the principle of combination is applicable to different rays of the same spectrum. This translates the existence in the molecular domain of a subdivision in levels of energy or quantum states, repeating on a very much reduced scale the succession of electronic layers of Bohr.

Finally it seems logical to include in the category of gamma rays these extremely penetrating radiations of cosmic origin, which (for the present) are the end of the spectrum of known, very high frequency radiations. Their existence has just been definitely proved (Millikan, Kohlhorster). These cosmic, or ultra-gamma, rays to which is due the increasing ionization ob-

¹Cosmic rays ultra gamma. There are also beta rays of 10,000,000 volts.

served progressively ascending in the atmosphere, could not be totally absorbed except in considerable material densities, for ex-

(nebulae) in which conditions of temperature and pressure are very different from those of the terrestrial globe

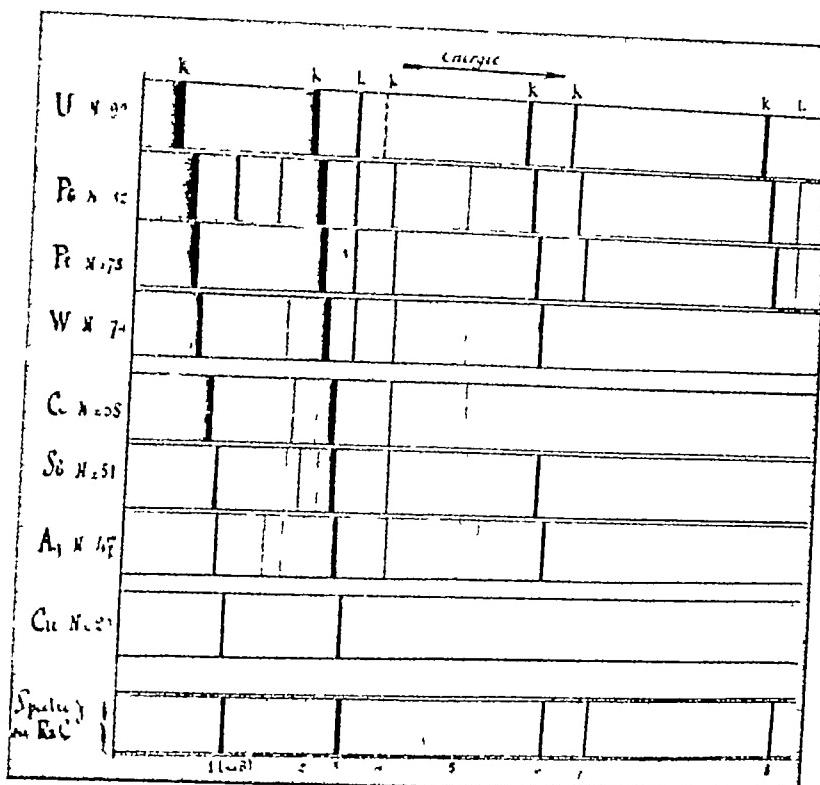


Fig. 4 Photo-electric β spectra produced by gamma rays of radium

ample, 23 meters of water or, again, 20 meters of lead. It is difficult to evaluate the quantum of such radiations possibly it would reach 20,000,000 or 30,000,000 volts. Their origin can be sought in the profound transformations of atoms of celestial bodies

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APPLICATION OF ROENTGEN RADIATION TO THE BARIUM-FILLED STOMACH

A CONTRIBUTION TO THE RADIATION TREATMENT OF INOPERABLE GASTRIC TUMORS

By THOMAS SCHOLZ, M.D., NEW YORK

THE most disappointing phase in the roentgen-ray treatment of malignant tumors has been the radiation results in inoperable gastric tumors. No matter what apparatus has been used and no matter what technic has been employed, the results, even in the most experienced hands, apparently have been not only uniformly negative, but in some instances the treatment has seemed to hasten the fatal course.

In view of such results it is no wonder that at the present time the consensus of opinion of roentgen therapeutists of wide experience does not favor radiation in inoperable gastric carcinoma. Pfahler (1) says:

*
In general, the intestine and the abdominal tissues will not stand the amount of irradiation necessary to destroy carcinoma of the stomach. We must obtain some addition to our present methods in order to accomplish such results. There is some hope in this direction.

Levin (2) declares

In my experience, high voltage X-ray therapy in carcinoma of the stomach has its value only as a post-operative measure, i.e., after the main tumor mass is removed surgically or else destroyed to a large extent by intramural radium insertion.

High voltage therapy, as well as surface or distance applications of radium in cases of advanced inoperable carcinoma of the stomach, has not given any satisfactory results as a general rule, though I did have a very limited number of cases in which there seems to have been a temporary improvement.

It frequently happens in my experience that a high voltage course either creates a cachexia or enhances the previously existent

cachexia. In view of all this I do not favor high voltage therapy as the only therapeutic measure in carcinoma of the stomach.

Wood (3) is of the opinion that "carcinoma of the stomach cannot be favorably affected by treatment with either type of radiation." And more recently (4) he states

I regret to say that I have never obtained results of any importance in irradiating carcinoma of the stomach. As a rule the patients are made more uncomfortable and I have abandoned treating such patients.

Forssell (5) in a recent article reviewing the irradiation results obtained in the Radiumhemmet at Stockholm makes no specific mention of gastric carcinoma. In Table IX of his article he classifies gastric carcinoma among that group of lesions in which surgery is the only applicable method of treatment.

My own experience in the treatment of gastric tumors dates back to the year 1915. From that time until the end of 1919 I treated with medium voltage rays, in the Lebanon Hospital and in private practice, altogether seven cases of inoperable gastric cancer without any appreciable results. Two of these patients, who were of advanced age and in whom gastro-enterostomy had been performed, died within 21 and 27 months, respectively, after the operation, while the remaining five younger patients, in whom only exploratory laparotomy had been done, succumbed within from two to nine months.

From 1920 until the end of 1922 I treated with high voltage rays six cases of inoperable gastric carcinoma. The results obtained

were, contrary to enthusiastic expectations, extremely disappointing. Radiation sickness became, in these cases, a more disturbing factor than before. In some instances it appeared as if the fatal course was hastened by treatment.

Of especial interest in this series was a case referred to me by Dr. Max Einhorn. The patient, a man 56 years of age, presented at the operation (performed by Dr. Willy Meyer) a large adenocarcinoma involving the middle third of the greater gastric curvature. A few days after application of a 115 per cent S.E.D. there appeared a brown discoloration of the body involving even those parts which had been protected by a heavy lead material. The discoloration gradually increased within the next two weeks and was associated with a very rapid decline of the patient's condition, followed by exitus five weeks after the operation.

This and other similarly disastrous results induced me at the end of 1922 entirely to abandon X-ray treatment for gastric carcinoma.

In 1923 there appeared an article by Holfelder (6) in which he, too, mentioned the uniformly disappointing radiation results in gastric carcinoma. At the same time, however, he pointed out that these poor results probably were due to an injury to the adrenals caused by the usual treatment technic. Experiments on guinea pigs had shown that the suprarenal glands cannot tolerate more than a 60 per cent skin erythema dose. In gastric carcinoma, therefore, he suggested the application of the rays at such an angle that the adrenals, or at least one of them, might completely be avoided. And in a later publication (7) he reported that with such a technic they have accomplished in gastric carcinoma "at least some results, while previously we have had nothing but disappointments."

MODIFICATION OF RADIATION METHOD

Holfelder's article gave food for new thought which gradually led to certain modifications of the technic in the radiation treatment of gastric tumors.

Taking it for granted that avoidance of the adrenals was essential for any successful radiation treatment in gastric tumors, it became evident that a reliable method for a definite localization of these glands in each individual case, would be of paramount importance. A few experiments with this objective indicated that the best way of accomplishing it would be by projecting in each instance the position of the adrenals and of the stomach upon the surface of the body. The position of the suprarenal glands could best be ascertained with the aid of a roentgenogram of the kidneys. By marking the position of the plate upon the patient's body before the exposure, one may transfer by means of a tracing of the plate findings the position of the kidneys upon the body surface. The outline of the stomach is marked upon the patient's abdomen directly by means of a contrast meal and fluoroscopy. Having thus obtained in visible form the exact location of kidneys and stomach and, therefore, also that of the adrenals and gastric tumor, one may easily succeed in arranging the direction of the rays so that at least one suprarenal gland may be definitely avoided.

During these experiments there also occurred the idea that it might be of value to increase the local X-ray effect in cases of gastric tumors by applying the radiation to the barium-filled stomach. As barium has a larger absorption coefficient than the tumor mass, there would therefore be produced in the barium-filled stomach a greater intensity of secondary radiation and a greater effect would be felt upon the adjacent tumor. This would possibly eliminate the necessity of high voltage rays and thus

increase the safety for the adrenals and also for the pancreas. Besides, the barium-filled stomach would in many instances almost completely protect the left suprarenal gland.

After deliberation it was decided at the beginning of 1924 again to take up X-ray treatment of inoperable gastric tumors, using the method just outlined, namely, surface localization of the adrenals and gastric tumor, selection of such a direction of the rays as to assure best possible avoidance of the adrenals, medium voltage rays, and application of the radiation to the barium-filled stomach. It was taken for granted that of the two types of secondary rays it would be the "characteristic" radiation which would mainly contribute to the increase of the local radiation effect. By very cautiously progressing with the dosage, it was hoped gradually to obtain a fair idea as to the therapeutic effect of the technic even without any previous experiments on the intensity of the secondary radiation.

The first case of "inoperable carcinoma" of the stomach treated with the above method was a patient in whom a gastro-enterostomy had been done. The patient is now, more than seven years later, in perfect health. Roentgen-anatomically the tumor mass has undergone a complete regression. However, as no microscopic findings were available, the case is published without any claims as to the nature of the lesion. The report, therefore, will be confined to clinical and roentgenologic facts.

REPORT OF CASE

History—Mr. A. P., 68 years of age, married, roofer by profession, always enjoyed good health prior to his present trouble. He drank beer and wine moderately, whisky very rarely, and did not smoke. Being of medium height, his weight normally used to vary between 156 and 160 pounds.

He ascribed the present complaint to a

severe injury to the abdomen sustained approximately two years previous to the examination. Local symptoms of that trauma disappeared within a few days. Nine months later, however, he began to experience an occasional "pain in the stomach," which had no relation to meals. He made no concessions to it, however, and continued his daily work.

After about five months he noticed a gradual loss of strength and weight, together with an increase in the frequency of the attacks of gastric pain which now seemed to become aggravated by food, however, his appetite still was good.

The following seven to eight months were characterized by intermittent periods of indigestion. In the meanwhile he had become accustomed to being "careful as to his food," and to restricting the amount of his daily work.

Approximately two months before the operation, he began to lose weight and strength more rapidly, the gastric pain became almost constant, appetite diminished, and constipation set in. He then decided to consult a physician.

Physical Examination—On palpation there was a moderately large, markedly tender, mass in the gastric region. Otherwise the examination was negative except for the suggestion of marked recent loss of weight (the patient now weighed 125 pounds) and an apparently greatly weakened general condition.

Laboratory Findings—Roentgen-ray examination showed "definite evidence of a neoplasm involving the pyloric third of the stomach, associated with very pronounced 6-hour gastric retention" (Fig. 1). Free HCl was present, though markedly diminished. There was occult blood in the feces. The blood picture was that of secondary anemia. The Wassermann test and urinalysis were negative.

A diagnosis of pyloric carcinoma was



Fig 1. Appearance of the stomach before operation showing almost complete obliteration of the pyloric third of the stomach outline.

made by Dr Max Krueger, the attending physician, and two gastro-enterologists. Immediate operation was advised.

Surgical Findings—Operation was performed on March 27, 1924, by Dr Alfred H Thomas, at the Staten Island Hospital. A tumor mass was found involving the pyloric third of the stomach, associated with marked and extensive enlargement of the regional glands. "The appearance of the tumor mass," Dr Thomas stated, "had all the characteristics of a large cancer, impossible to remove." A gastro-enterostomy was done. No tissue was removed for histologic examination.

The patient was referred for radiation treatment on April 24, five weeks after the operation. There was, at that time, a moderately tender, palpable mass in the mid-gastric region. He complained of slight oppression and pain after meals. His weight was now 121 pounds.

RADIATION METHOD AND ITS EFFECT

First, a projection of the renal and adrenal outlines upon the patient's abdomen and back was obtained in the manner described above. The patient then was given a barium meal. The stomach could hold only one-half of a glass of the contrast mixture. The plate findings as shown in Figure 2 are self-evident. The patient after-

ward was placed on a fluoroscopic table and the outline of the stomach was marked on the abdominal surface. The gastro-enterostomy stoma was found to be working well.

From the gastric and adrenal outlines thus obtained, it was evident that two portals of entrance—anteroposterior, with a slight tilt caudalward, and left lateral—would assure avoidance of the suprarenal glands in this case. In estimating the radiation dose to be applied it was deemed advisable to observe the rule of *nil nocere*, in view of the unknown factor of secondary rays produced by the barium-filled stomach. After considering all the various factors (which will be discussed more elaborately in a special paper), the following was decided upon mechanical rectifier, 145 KV peak, 5 mm filter, 50 cm distance, dose, 350 r.

The dose was repeated after four weeks and was again repeated five times at intervals of three weeks. Finding no reaction of any kind which could be attributed to the radiation treatment, five more applications under practically the same technical conditions were given at intervals of two weeks followed by a rest period of three weeks. When again no local reaction appeared, the roentgenologic appearance of the stomach remaining the same, though there was definite clinical improvement, the intervals between the radiation treatments were cut down to one week.

A few days after the third of these treatments, the patient began to complain of "pain in the stomach with a feeling of soreness," markedly aggravated by food. On palpation there was found very pronounced local tenderness, and, on fluoroscopic examination, very great gastric spasticity. The roentgen treatments were interrupted, the patient being put to bed and placed for three weeks on a fluid diet.

In the course of approximately two months, the acute symptoms gradually dis-

appeared There still remained a palpable mass, moderately tender to touch, and occasional feeling of oppression and pain after meals Roentgen-anatomical evidence, however, seemed now to indicate beginning

and the other two series were given during the last part of each year No treatments were applied during the months of June, July, and August A final two treatments were administered during the first half of

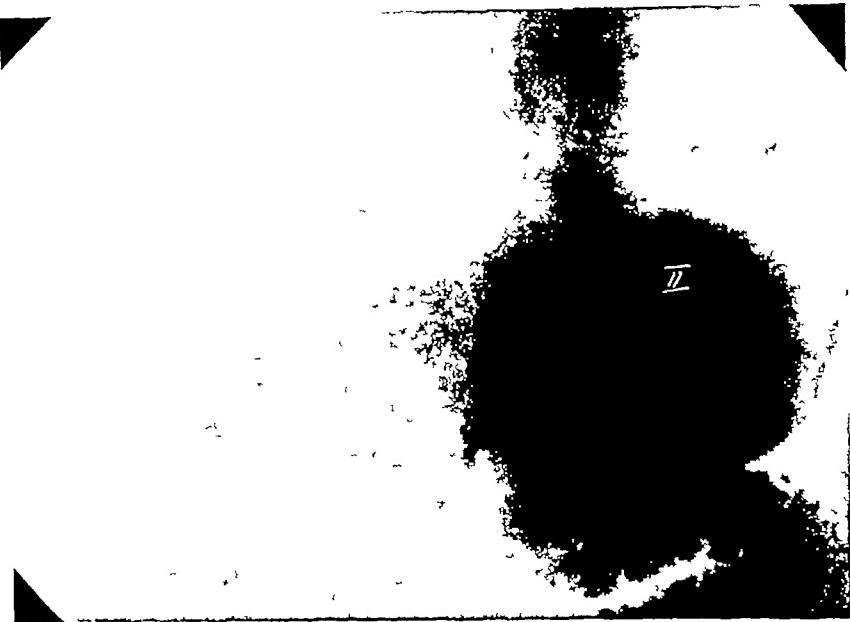


Fig 2 Appearance of the stomach after operation and at the beginning of the radiation treatment

regression of the tumor along its proximal periphery

The radiation treatment was taken up once more, the dose described above being applied every two weeks After the fourth treatment, there again appeared moderately marked permanent gastric pain The treatments were discontinued and within four weeks the pain again disappeared Roentgenograms now revealed more definite evidence of a recession of the tumor mass

On the strength of the experience gained so far, the treatments during the following years, until the end of the fifth year, were given in the form of four series each year Each series consisted of three treatments at intervals of two weeks Two such series were applied during the first part of the year, being separated by a longer interval,

the sixth year, approximately one and one-half years ago

The roentgenographic appearance of the stomach was watched by frequent X-ray examinations Following the first slight suggestion of roentgen-anatomic improvement, found approximately one year after beginning of the treatment, the regression of the tumor became more definite during the succeeding months It continued steadily until, at the end of the fifth year, there appeared, roentgenographically, to be a normal stomach (Figs 3, 4, 5)

The improvement in the general subjective condition of the patient was more rapid He considered himself perfectly healthy at the end of the third year Gastric pain disappeared within two years, palpable tumor within three years, and tenderness on

palpation within four years. At the present time, more than seven years after the operation, the patient is in excellent health, is of normal weight, and is able to do an amount of work which may be considered normal for his age, 75 years.

regression. Where there previously had been a solid tumor almost entirely obliterating the pyloric third of the gastric cavity, the latter was gradually re-established by the recession of the lesion to such an extent that, roentgenographically, there finally was ob-

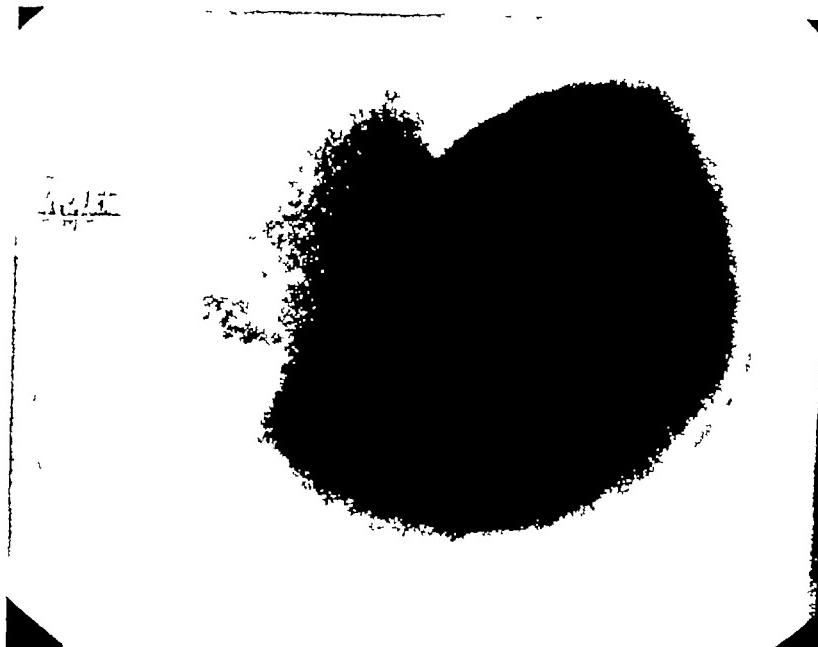


Fig. 3 Appearance of the stomach after two years of roentgen-ray treatment.

COMMENT

For a correct evaluation of the case just reported, various points have to be taken into consideration.

In view of the lack of microscopic findings, one cannot, of course, definitely consider the lesion one of gastric carcinoma. However, its characteristic clinical course, its macroscopic appearance as observed by an experienced surgeon, and the extensive involvement of the gastric and mesenteric lymph nodes make it more than probable that the condition was of a malignant type.

As to the therapeutic result, there is no doubt but that clinically a cure has been accomplished and that roentgen-anatomically the tumor mass had undergone a complete

tained normal pliability and peristalsis of the entire gastric wall.

As to the causes for these gratifying results, all those factors ought to be taken into consideration which might possibly have contributed to them.

First, the patient's age was a favorable factor, because it is a well-known fact that, with advancing age, the malignancy of cancer as a rule decreases, while at the same time the tendency towards regression increases.

Secondly, spontaneous regression in carcinoma, as pointed out by Lohmer (8), Rohdenburg (9), and Trinkler (10), may have played an important rôle in this case, too. This point is of greater importance than is generally realized. A careful study



Fig 4 Appearance of the stomach four years after beginning the X-ray treatment

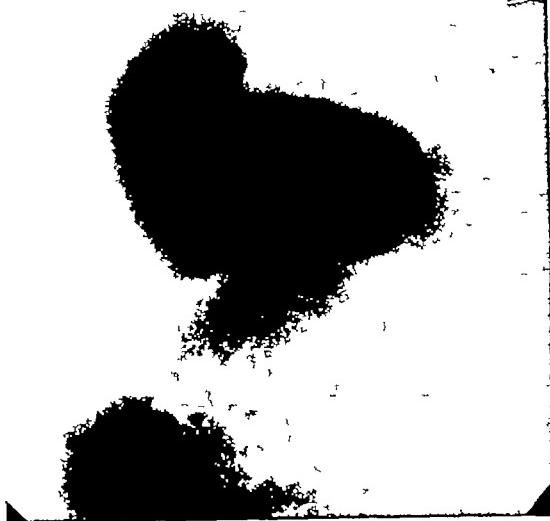


Fig 5 Appearance of the stomach at the end of the fifth year

of the instances of spontaneous cancer cures reviewed by the above authors definitely shows that the human body is not absolutely helpless against the carcinomatous growth. On the contrary, there seem to be factors, not properly understood yet, which apparently aid in or give the first stimulus for the regressive process. A more thorough study of these conditions will go far toward a proper understanding of the cancer problem. Such a study may prove of especial value in gastric tumors, because, as Ewing (11) has pointed out, and systematic X-ray examinations have shown, gastric cancer, more than any other cancer, is characterized by an intermittent growth. There often are long periods during which the growth remains stationary. Factors aiding regression brought into play during such stationary periods may become invaluable.

That gastro-enterostomy in inoperable gastric cancer occasionally is followed by a remarkable improvement, sometimes bordering on a complete cure, is a well-known fact. During my own observations, over a period of more than 20 years, in a large number of cases of carcinoma of the stomach, especially among the extensive material of the Montefiore Home, I have seen such patients remain alive for a long time almost sym-

ptomless, as much as from three to five years after the operation. This would tend to support the theory of chronic irritation, because there is no doubt but that a gastro-enterostomy, especially in obstructive pyloric carcinoma, greatly relieves the irritating factor. We would have to admit, therefore, that in our case, too, the gastro-enterostomy may have played an important rôle.

The general medical care and handling of the patient has, of course, a great influence upon the therapeutic outcome. General measures for the purpose of strengthening the patient's vitality and increasing his power of resistance along the lines recently suggested by Jackson and Minot (12) are extremely helpful. Ease of digestibility and elimination of irritation possibly arising from certain articles of food should be important guiding factors in the selection of the diet. Conditions in this respect were in our instance, fortunately ideal.

Finally, in regard to the X-ray treatment there is no doubt but that it has played a rôle

in the therapeutic accomplishment. This is demonstrated by the fact that the regression set in only after an apparently sufficient amount of radiation had been applied. Furthermore, that the "characteristic" secondary rays probably were of decisive importance is suggested by roentgen-anatomic evidence to the effect that the regression started along the proximal periphery of the tumor and then gradually progressed towards the pylorus. In other words, the regressive process always was taking place along the contact line between tumor and barium. Besides, this radiation method has so far been used in five additional cases with apparently encouraging results. The dose, however, has since been slightly modified.

It would lead too far afield here to touch upon all the problems involved in the radiation treatment of the barium-filled stomach. A more detailed discussion of them will be published after the completion of certain experiments which are being carried on in collaboration with Dr Arthur Mutscheller. Besides barium sulphate, bismuth-subcarbonate was used as a contrast medium. Experiments also were made with mixtures consisting of barium or bismuth, and other metallic powders, in an attempt to ascertain the best possible type of fluorescent radiation. In this respect, magnesium oxide, in its heavy and light forms, and calcium, seemed to give favorable results.

CONCLUSIONS

1. Roentgen radiation applied to the barium-filled stomach in inoperable gastric tumors seems to aid in the bringing on of the regression of the tumor mass.

2. Avoidance of the adrenals in the application of radiation to the stomach is of great importance.

3. The best way to avoid the adrenals is by definitely determining in each individual case the exact position of the suprarenal glands and of the stomach. This can be readily accomplished by projecting the outline of these organs upon the surface of the body.

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ON INTRATHORACIC LOCALIZATIONS BY STEREOROENTGENOGRAPHY, WITH A CONSIDERATION OF THE SOURCES OF ERROR

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T has been observed by many working in roentgenology that stereoscopic radiographs commonly produce effects that are obviously faulty and illusory. We frequently encountered such troubles during the course of some recent work on the exact localization of cavities in patients with pulmonary tuberculosis, which involved the study of stereoscopic radiographs (1). In this work, mensuration was attempted on 250 pairs of stereoscopic radiographs, but 14 were found to have such pronounced distortion that a good deal of the contents of the thoracic cage was projected beyond its confines. This represents about 5 per cent of the total number, and we believe that it is a fair average for routine institutional work. It should be explicitly stated that very pronounced distortion existed in these 14, there were, of course, many more that were not rejected or even detected because of only very slight distortions. So far as we are aware, no analysis or explanation of such phenomena has ever been made. The problem seems to be of sufficient importance to merit such attention, inasmuch as stereoscopic X-ray examinations are among the most valuable aids in this branch of medical diagnosis.

The discovery of discrete pulmonary lesions that appeared to be outside the bony thorax when viewed stereoscopically led us to make observations on the other structures shown in these stereoscopic views. It was found that either one or more of the following conditions existed:

1. The ribs had shifted more than usual.

2. The width of the chest had altered.

3. The domes of the diaphragm had shifted anomalously.

These are all caused by the patient making respiratory movements between exposures, the most common cause being diaphragmatic breathing. Independent of the respiratory movements, and perhaps more common, but less marked, are disturbances which are caused by the heart beat.

A brief review of the principles involved are given for the sake of clarity. Stereoscopic observation is an attempt to reproduce normal vision by means of a pair of photographs so that normal plasticity will be revealed. It is a well known physiologic and psychologic fact that a realization of the third dimension in stereoscopic vision is largely a matter of education and experience. The realization of plasticity, or the judgment of depth, by one person may be more accurate than by another, the relations of objects to one another, regardless of the observer, however, will be proportional, so that correct ratios will be the same in the case of two observers. There is no established usage for the exposure of the two films of a stereoscopic pair, and the distances used for the target-film distance and tube shift are so different in the various laboratories that each worker forms his estimates from the sort of usage to which he is accustomed. The distance between the eyes is very nearly the same in all observers, and, accordingly, our judgment of distance in naked-eye vision is always based on the same

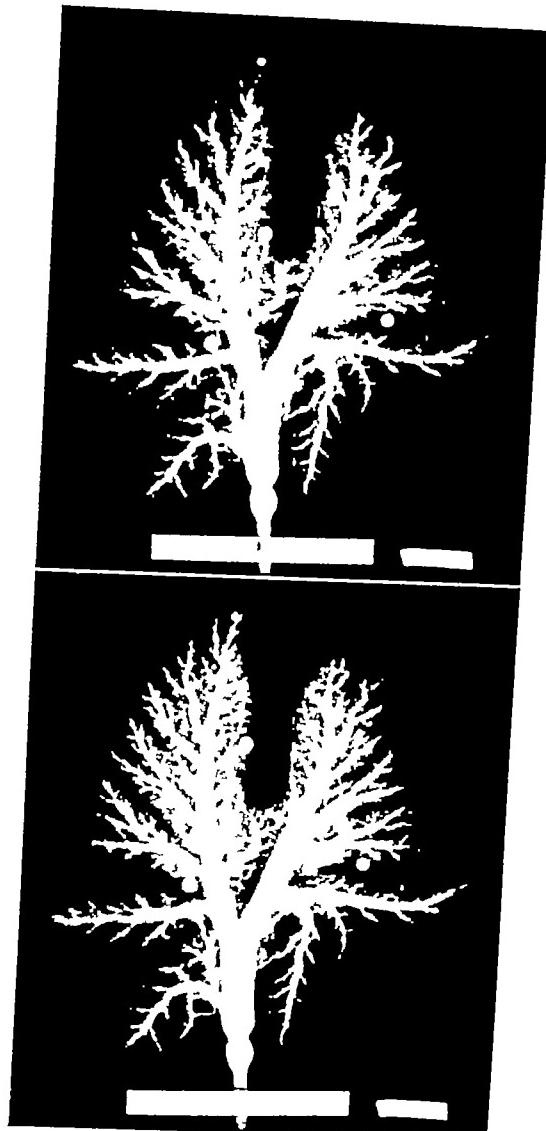


Fig 1. Photograph of a pair of normal stereoscopic radiographs of a hog's lung, containing lead pellets, and injected with dental cement, reduced for viewing in a hand stereoscope

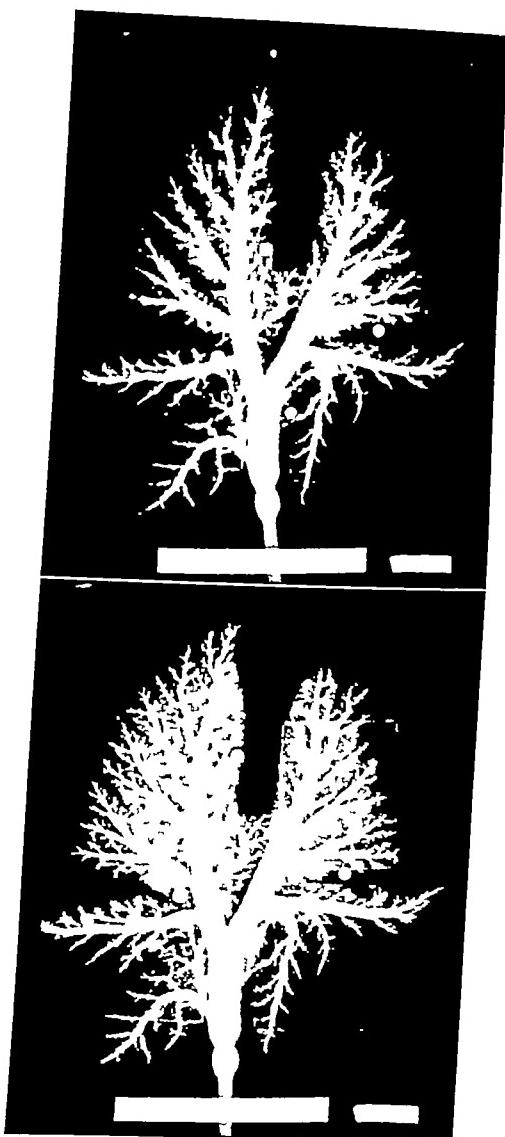


Fig 2. Same as Figure 1 except that traction was put on the lower lobe at Pellet No. 1, and the tip was pulled down 2 cm., resulting in marked distortions

distance apart on the datum line, which, of course, is not the condition in X-ray stereoscopy. This phase of the subject has been ably discussed by Stephenson (2). It was Helmholtz (3) who first thoroughly explained the physiology of binocular vision, showing that the viewing of an object from two slightly different angles will give it plasticity. Elihu Thomson (4) was the first, in 1896, to attempt the application of

stereoscopic vision to X-ray work. He was followed by Davidson (5) in 1897, who successfully utilized the now familiar Wheatstone reflecting stereoscope and, incidentally, pointed out the distortion which is caused by motion between exposures. Also, his method for the localization of foreign bodies has been a model for many others.

The type of distortion depends on the direction and extent of the motion, for ex-

ample, the normally resulting stereoscopic shift is exaggerated on the radiographs when the tube shift is downward (which is the universal practice) and the diaphragm motion between exposures is upward, as is the case when the patient exhales. In this event the contents of the thorax will appear to be abnormally posterior, or nearer to, the observer. In extreme cases the bases of the lungs will appear outside the posterior ribs.

On the other hand, if the diaphragm moves downward (inhalation), the contents of the thorax will appear to recede from the observer and to be displaced anteriorly in the patient. This tends to annul the normal stereoscopic shift, resulting in a loss of depth. If the normal stereoscopic shift is just annulled, the object viewed will appear to be in the plane of the film, which is anterior to the chest. Furthermore, if the downward motion of the diaphragm causes a greater shift than the normal stereoscopic shift, the object will appear far anterior to the patient's thoracic cage.

In a similar manner, the movements of the heart will cause a distortion of the heart shadow and adjacent lung tissue, unless the exposure happens to be at exactly the same phase of the heart cycle. Such cardiac movements, however, are in no way related to the movement of the bony framework of the chest or the diaphragm, and may be

in any direction instead of parallel to the shift.

In the examination of a pair of stereoscopic radiographs of the chest, therefore, there are several preliminary scrutinizing observations that should be made. First, one should see that all lateral dimensions of the bony framework are identical, that is, the distance between the scapulae, the overall width between any pair of ribs, or the lateral distance of any object to the ribs, or midline, should be exactly the same on both. This is usually not true if respiratory movements of any kind have taken place.

EXPERIMENTAL

After rather extensive experimentation, we were able to prove the above-mentioned theory by a simple experiment. First, we used hogs' lungs in such a way that the various measurements could be obtained absolutely as well as geometrically and stereoscopically, and, second, we were able to apply this information to a practical problem on a patient who had a disseminated, partially healed, small, nodular pulmonary tuberculosis.

Experiment 1—In a hog's lung (fresh) the bronchial tree was filled with an "artificial stone"¹. This was placed over an improvised tunnel for the X-ray film holder, on

¹This product is a slow setting dental cement.

TABLE I—MEASUREMENT OF PELLETS IN HOG'S LUNG

| Pellet number | Estimated Stereoscopic observation | Calculated | | | Measured | | | % error between calculated and corrected measure |
|---------------|------------------------------------|------------|------------|---------|----------|-----------------|-----------------|--|
| | | 2-in shift | 4-in shift | Average | Distance | Correction | Corrected value | |
| 1 | 2.2 | 20 | 20 | 20 | 25 | 0.2 + 0.4 = 0.6 | 19 | -50 |
| 2 | 4.4 | 56 | 54 | 55 | 62 | 0.1 + 0.4 = 0.5 | 57 | +40 |
| 3 | 8.8 | 90 | 86 | 88 | 96 | 0.4 + 0.4 = 0.8 | 88 | 00 |
| 4 | 9.7 | 100 | 92 | 96 | 120 | 0.5 + 0.4 = 0.9 | 111 | +150 |
| 5 | 0.0 | 0.4 | 0.6 | 0.5 | 0.8 | 0.4 + 0.4 = 0.8 | 0.0 | 00 |
| 6 | 5.9 | 56 | 54 | 55 | 65 | 0.4 + 0.4 = 0.8 | 57 | +40 |
| 7 | 0.0 | 0.0 | 0.5 | 0.3 | 0.8 | 0.4 + 0.4 = 0.8 | 0.0 | 00 |
| 8 | 33.2 | 0.0 | 31.2 | | 0.0 | | 0.0 | 00 |

top of four halves of pasteboard microscopic slide boxes one inch deep, a number of lead pellets were placed at different levels throughout the lung and directly over the film. One pellet was suspended above the

Column 5 The actual distances according to measurement are in Column 6, with corrections in Column 7, and the corrected values in Column 8. The correction is due to two things first, the sag in the top of the

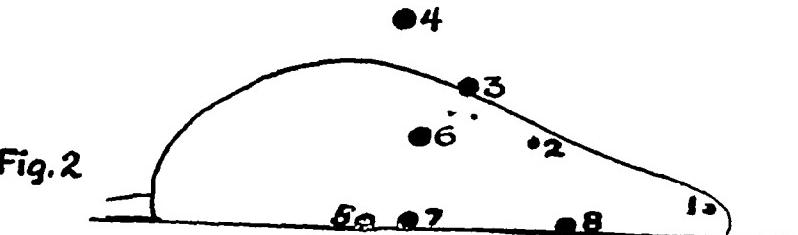
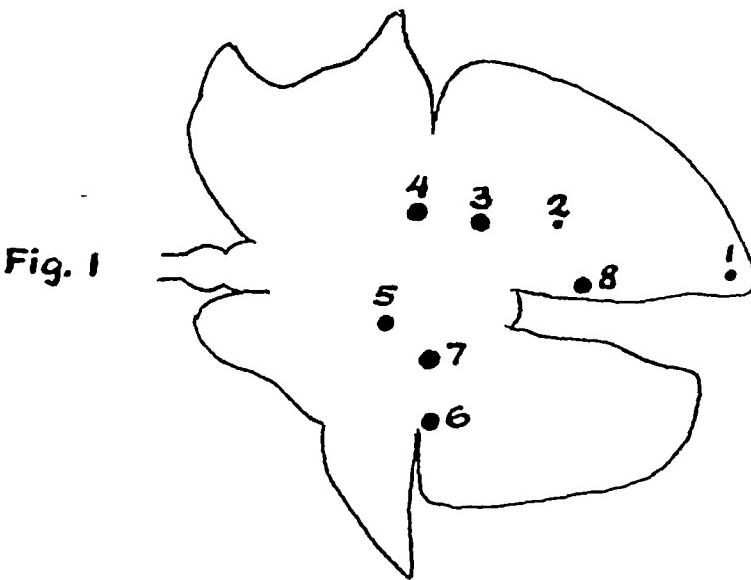


Chart I Diagrammatic sketches of Figure 1, showing the positions of the lead pellets Fig. 1, anteroposterior view, Fig. 2, lateral view

top surface by means of cross-threads. The distance of each above the film was measured, and then stereoscopic radiographs were made, using a 40-inch focus-film distance, and four- and two-inch tube shifts, respectively. The measurements and calculations are tabulated in Table I. The estimated distance by stereoscopic observation is in Column 2, the distances calculated by measuring the shifts are compared in Columns 3 and 4, with an average in

X-ray table, which was actually about 4 mm, and, second, the half diameter of all the pellets, because the measurements were made from their tops and not the equatorial plane which casts the shadow.

Pellet No. 4 was suspended by cross-threads above the whole lung specimen, but no doubt was moved in shifting, as a movement of only 1.5 mm would account for the discrepancy between the shift value and the actual measurement. The position of Pellet

No 8 is purely illusory. It was simply rolled along the film parallel to the shift, and appears far out toward the observer. These conditions are shown in Figure 1, which is so arranged that it may be viewed

posterior and lateral views of the specimen shown in Figure 1

Experiment 2—With the lung in the same position as in the second exposure, a thread was attached to the tip of one of the right lobes, and the tip pulled downward parallel to the direction of the tube shift (inhalation), a distance of 2 cm., and while it was in that position a third exposure was made. This is shown in Figure 2, which also is placed so that it may be viewed by a hand stereoscope to show the real and illusory positions of the various objects. The lung appears extremely distorted, which can be explained only when the movements are understood. The pull on the tip of the right lung stretched the whole right side downward with the shift, the bronchus and adjacent parts stretching the most with the displacement, gradually diminishing upward towards the trachea. This was possible because the cast was not completely "set." The outer and upper parts of the lung either lagged behind, or were actually tilted in the opposite direction. This combined effect would produce three distortions, *viz.*, (1) posterior, (2) loss of plasticity, and (3) anterior. The posterior distortion (*i.e.*, appearing toward the observer) is due to the lack of movement or movement opposite the shift, and is shown by the curling up of the tips of lobes toward the observer, as well as a nearer view of Pellet No. 4, which was suspended above the lung. The loss of plasticity is due to the movement of the main bronchus with the shift. When this movement is equal to the shift displacement, there is no plasticity. The object then appears flat and in the plane of the film (Pellets Nos. 2 and 3). When this shift displacement has been equalized and greatly exceeded, as in Pellet No. 1 and the tip of the lobe, they appear anteriorly (or away from the observer).

Fig. 3. Stereoscopic X-ray view of patient with disseminated nodular tuberculosis, after exhalation (crusing the diaphragm). The contents appear to be posterior.

with a hand stereoscope. Chart I is a diagrammatic sketch, to show the anterior-

After this demonstration the study was directed to an actual living example, and we



were so fortunate as to find a suitable patient.

Experiment 3—A series of exposures under different conditions were made as follows. First, a double exposure was made

correct exposure (shown by the dotted lines).

Subsequently, we observed that certain distortions took place even when respiratory and other external movements were con-

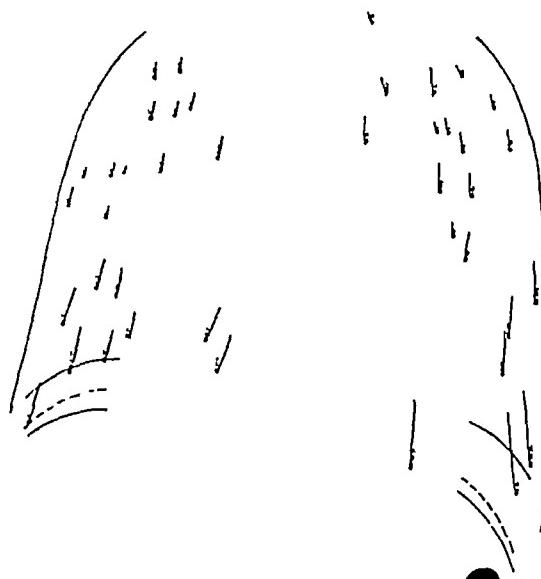


Chart II. Sketches of double exposures taken of the patient shown in Figures 3 and 4. Dotted lines show the shift of the tubercles on a normal exposure. The solid lines show the shift of the same tubercles on rising the diaphragm (exhalation).

on the same film, one exposure before and one exposure after the shift. This doubly exposed film enabled us to measure the shifts of various shadows on one film with considerable accuracy. These are shown graphically by the dotted lines in Chart II, and reveal the fact that some of the shadows shift much more than others.

Experiment 4—Two more sets of exposures were made, one with inhalation (lowering the diaphragm) and one with exhalation (raising the diaphragm) between exposures. The latter is shown in Figure 3, and reveals the fact that the position of much of the contents of the thorax appears to be posterior to the posterior ribs. The total shift of many of the shadows is shown by the solid lines in Chart II. There is about three times as much shift as in the



Fig. 4. Same as Figure 3 except that respiratory and cardiac movements were controlled as much as possible and so the contents appear in reasonably normal position.

trolled. It was first suspected, then demonstrated, that the heart movement produces almost as much distortion as do movements of the diaphragm. In fact, when there is

otherwise good technic, this factor is the most common source of distortion, and one that has not been exhaustively studied²

In this report we have made no attempt to "control" the heart movements with respect to the exposures further than crudely to expose pairs of radiographs in the same and in diametrically opposite phases of the cardiac cycle. The effect of this movement has wide possibilities, depending on whether the movement resulting is *with* or *against* the shift of the target. The vertical component of a movement *with the shift* will produce only a loss of plasticity, while displacement *against* the tube shift will project the image further posteriorly, depending on the amount of the displacement. For example, if the shift displacement on the radiographs is 1 cm., and the movement caused by the heart is 2 mm. (one-fifth the former), the lung would appear one-fifth, or 20 per cent, out of the chest posteriorly, and proportionally so for any other distance. With the first exposure during the height of systole, and the second similarly in diastole, the shift displacement would be lessened, with only a reduction of depth or plasticity. In addition to the vertical, there are other components that we have not attempted to study.

To test some of these hypothetic considerations, we performed two experiments in an attempt to establish them as facts.

Experiment 5—A "normal" was made in which both films were exposed in approximately the same period of the heart cycle, the exposure being manually controlled by observing a blood pressure manometer. Although there is still slight distortion, the stereoscopic visualization is much more nearly correct than in Figure 3, in which deliberate respiratory movement had taken place.

Experiment 6—Two exposures were made on the same film, approximately a half-second apart, so that the exposures would occur in the opposite phases of the heart cycle. There resulted a maximum of blurring and duplication of the shadows, especially in the right side, with an average displacement of about 3 millimeters. The direction is parallel to the shift throughout most of the field, but near the periphery it is more oblique or horizontal. Why the left side did not react in the same manner, we are unable to state, but it seems always to be so, and, of course, is dependent on the anatomic arrangements.

Experiment 7—Another experiment was performed in which stereoscopic views were taken in the same phase of the cardiac cycle. Here the exposures were made in approximately the same phase and were reasonably correct (Fig. 4). All of these displacements can be explained, however, on a basis of movement with or against the shift between exposures.

Factors that may exaggerate the distortion by cardiac movements are consolidations or adhesions between the pericardium and the lung, or between the pericardium, lung, and thoracic wall. Each different possibility of anatomic aberration will be reflected in a different type of distortion unless the exposures are made at exactly the same phase of the cardiac cycle. Up to the present time, however, there is no simple, accurate means of accomplishing this, and until this is effected, exact localizations in the region of the heart will be impossible. Upper lobe lung localization can be accomplished, however, with a fair degree of accuracy, because these lobes are not disturbed so much by cardiac movements. In viewing a pair of radiographs caused by a diaphragmatic movement, distortion is not evident until the hilum is approached from above. Below the hilum it becomes gradually more marked. The distortion due to

²Since this work was completed we have learned of the excellent work of McPhedran and his associates which aims to eliminate this source of error.

cardiac movements is more marked near the heart, but may be quite irregular if there are adhesions present, when the distortion varies with the extent and location of the adhesions

DISCUSSION

Some of the important lessons of these studies are the bearing they may have on intrathoracic localizations and the interpretation of distortions appearing in routine stereoscopic examinations. As a result, more accurate localizations of lesions are made possible if unsatisfactory radiographs are discarded. Unless these distortions are recognized, however, localizations within the chest will frequently be difficult, if not impossible, to perform within a sufficient degree of accuracy to be of practical value. Respiratory movements are easily controlled and should offer no obstacle to accuracy. By superimposing the bony landmarks, such as scapulae, clavicle, greatest width of thoracic cage, etc., such movements may be easily detected and the faulty radiographs discarded. The heart movements, however, are entirely different, because they are not under the control of the operator, and their detection is not so easy since no signs of them are apparent in the bony framework. There is no sure method of control except to attempt to obtain the exposures in the same phase of the cardiac cycle. This is difficult to do and our attempts have been very unsatisfactory except to point out the possibilities of such movements. Localizations near the heart are, therefore, unreli-

able, and, if fibrous adhesions exist either between the pericardial and visceral pleura or the visceral and parietal pleura, the situation is further complicated. Movements of from 2 to 3 mm. will produce gross distortions.

SUMMARY AND CONCLUSIONS

Evidence has been offered revealing various types of distortion of stereoscopic X-ray images in radiographs of the chest. Assuming that the exposures are taken in a correct manner with optimum tube shift and distance, and that the viewing apparatus is properly adjusted and correctly used, there are still possibilities of error due to movement between exposures if certain precautions are not closely adhered to. These errors are due to three types of movement: respiratory, cardiac, and that of the trunk as a whole. Cardiac movements are quite variable, but many times, if adhesions are present, they interfere with any localization around the heart. The type of distortion depends upon the direction of the motion, which, in turn, depends on the relative phase of the cardiac cycle at the instant of exposure.

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ROENTGEN DIAGNOSIS AND TREATMENT OF PERSISTENT THYMUS

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CONTROVERSIAL issues abound in medicine no less than in other scientific endeavors, and this is said without disparagement. In some cases the unquestionable association of cause and effect is convincingly established and needs no further elucidation or defense.

Ever since 1614, when Plater reported a sudden death, without apparent cause, in a five-months-old child, in whom necropsy revealed an enlarged thymus as the only abnormality, considerable discussion has clouded the issue of status thymicolymphaticus, which was first advanced as a definite clinicopathologic entity by Paltauf in 1889. The latter described this condition as due to a decreased resistance of the body to shocks or injuries, dependent on a specific constitutional anomaly, shown anatomically

by prominent thymic and lymphatic tissue. This has been generally accepted.

However, in 1926, the British Medical Research Council and the Pathological Society of Great Britain and Ireland appointed a joint committee to investigate status lymphaticus. The object was to establish by means of a large series of weights and measurements the standards for age and proportion to body weight of the normal thymus at all ages, also to investigate closely the cause of death in persons dying suddenly from unexplained or seemingly trivial causes, wherein the only apparent abnormality was the presence of a large thymus.

The committee determined that, in the normal series up to sixteen years of age, there appears to be little, if any, association

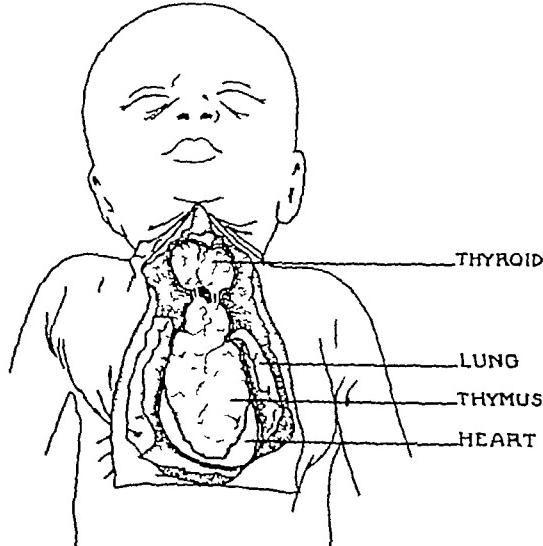


Fig 1 Showing relation of the thymus to some of the neighboring structures

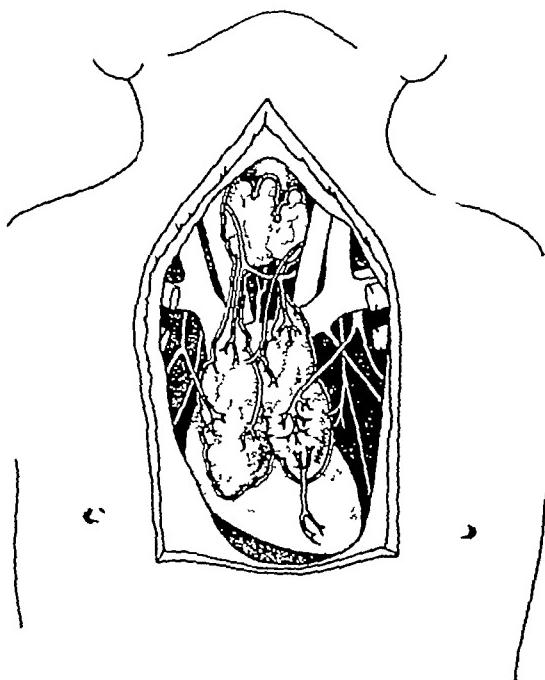


Fig 2 Detailed dissection showing nerves and carotid and innominate vessels
(From Crotti)

between the weight of the thymus and the amount of lymphoid tissue in the various parts of the body, insofar as this amount can be indicated by volumetric measurements of the faucial and lingual tonsils, selected lymph glands from certain sites, Peyer's patches, etc. The few data available show no concomitant general hyperplasia of lymphoid structure in cases with abnormally large thymus. They concluded that in many cases of Graves' disease the thymus was large, due to increase in glandular tissue, yet there was no definite general hyperplasia of lymphoid structures. They also agreed with Hammar and Greenwood, and Woods, that there is no evidence that so-called "status thymicolymphaticus" has any existence as a pathologic entity.

So, for the sake of agreement, let us acknowledge that there is such a thing as an enlarged thymus, since this committee has recognized its occasional presence, as have roentgenologists, also, certainly, pediatricians have clinically recognized its existence for a long time.

Noback has shown that the lobation of the thymus is determined early in fetal life, that the bilobed type of thymus predominates and that its location is most frequently cervicothoracic. The organ is distinctly broad in outline, extending laterally as far as the anterior axillary line in most cases, and is practically never overlapped by fetal lungs. This distinctly broad type of thymus, described as being the fetal type, he also showed to be typical of full-term, stillborn babies.

The thymus of infants in whom respiration has been established is usually cervicothoracic in location, is elongated in form, and bears the impress of the organs with which it is in contact. The right lung extends on its anterior surface in every case, the left lung extends over its anterior surface in four out of five cases. The thymus overlaps the right ventricle of the heart in

more than 50 per cent of cases, and on the left side in more than 75 per cent.

The change from the broad type to the elongated type of thymus, found in the individual who has breathed, is accomplished during the period of time in which respiration is completely established. The expansion of the lung changes the position in relation to the thoracic contents, and, along with the other organs and viscera of the thorax, the thymus is markedly affected. It is compressed both laterally and anteroposteriorly, requiring a certain amount of molding.

Noback believes that, in the neonatal period, the degree of expansion of the lungs is a more potent factor in determining the lateral extent of the thymus than the actual size of the organ and, during this period at

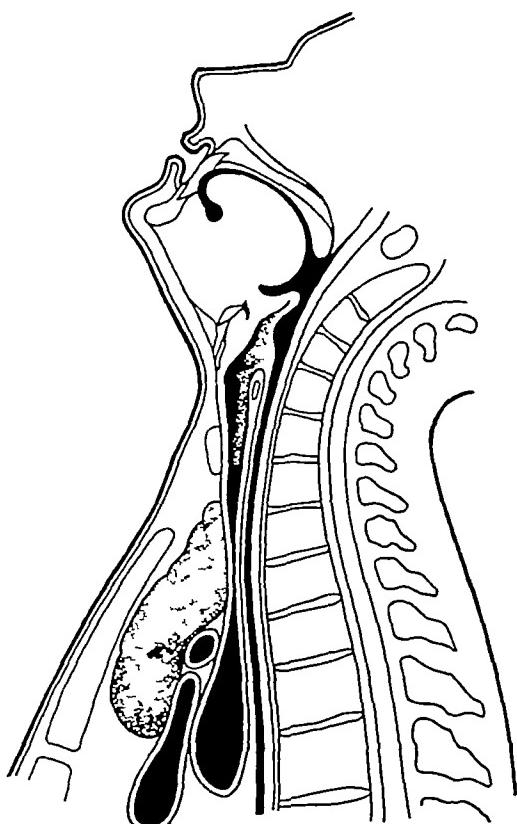


Fig. 3 Normal relation of thymus. Any increase in size would cause pressure symptoms at anterior spur triangle.

least, the thymus, lying in the usually described normal area, may exert marked pressure on the structures posterior to it. This may be due to an unusually large thymus or to a very narrow superior thoracic aper-

dium over the base of the heart and great vessels. Noback says that in exceptional cases it extends to the left vagus nerve. On the right side it is generally found to be close to the superior vena cava, the left in-

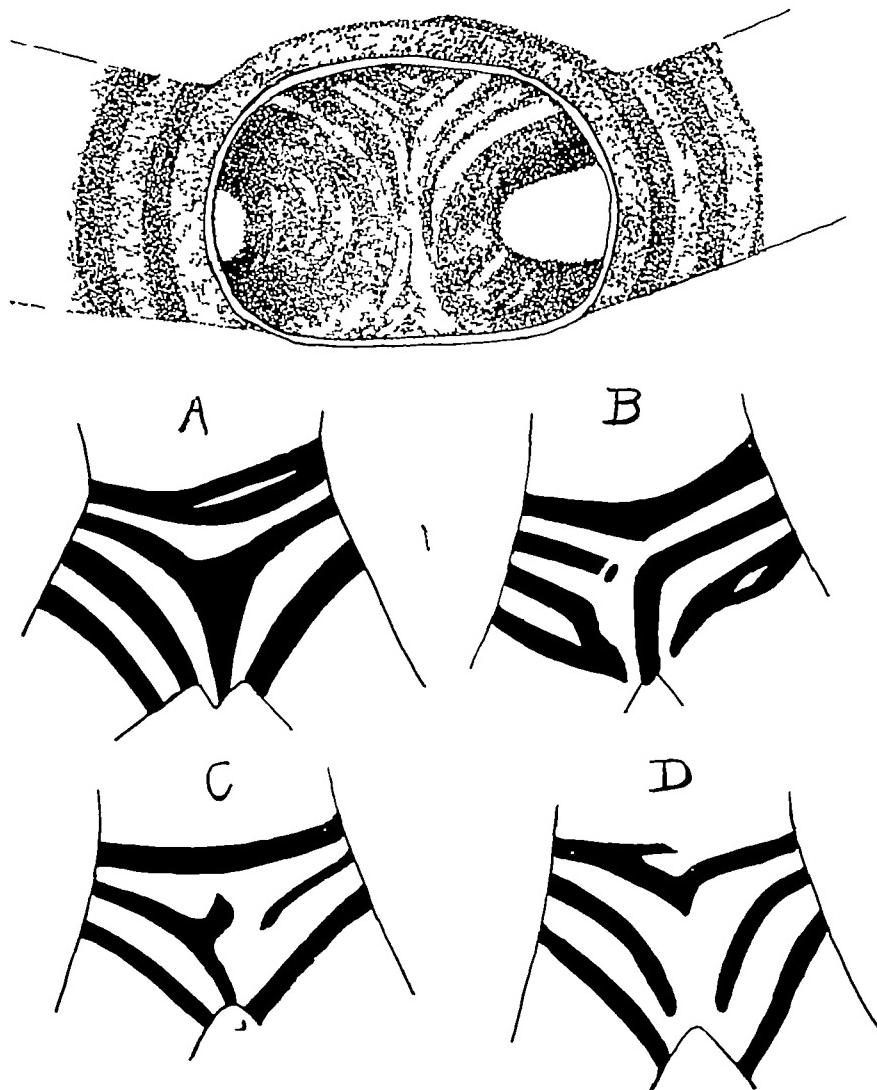


Fig. 4 (upper) Cross-section of trachea, showing cartilaginous rings
Fig. 5 (lower) Various forms of tracheal ring architecture

ture, which will not allow the thymus to protrude into the cervical region, as it is compressed by the expanding lung.

Late in fetal life and in the unborn the thymus is related posteriorly to the pericar-

nominate vein and occasionally the superior vena cava being embedded in the posterior aspect of the thymus. In a few cases, he found that these vessels actually ran through the substance of the gland. The innominate



Fig 6 In this case the spinal deformity confused the diagnosis, however, treatment was given, with abatement of symptoms.

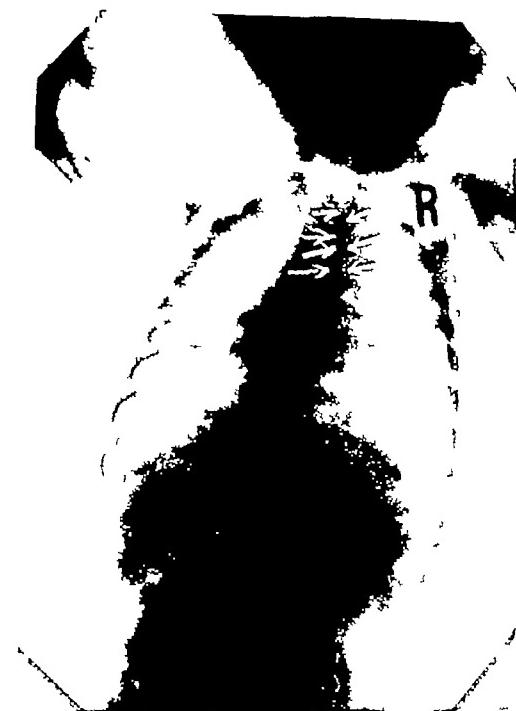


Fig 7 Note tracheal displacement.

artery is closely applied to the trachea and crosses it diagonally, and the left innominate vein passes across the artery at the level of the upper border of the sternum. An increase in the anteroposterior extent of the thymus in this region would, he says, due to the rigidity of the superior thoracic aperture, compress the above-named structures.

Jackson states that tracheal collapse in infants is as easy to accomplish as collapse of the bulb of a medicine dropper, also, thymic deaths under anesthesia attributed to status lymphaticus and hyperthyroidism of the blood are nothing more or less than arrested respiration due to obstructive pressure of the engorged thymus. In view of these observations and their confirmation by roentgenologic studies, the compression theory is tenable.

At this point it might be desirable to call attention to the work of Heller and von Schrotter regarding the anatomic structure

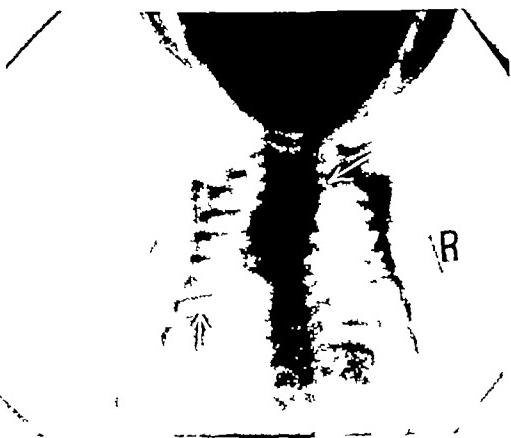


Fig 8 Thymic enlargement is toward the right. Signs of rickets are present.

of the trachea and bronchi. Their results may be summed up as follows:

If the trachea is cut off 2 cm above its division, an exact view of the place of bifurcation is afforded. One sees, looking at such a preparation from above, a nearly sagittally arranged larger or smaller ridge dividing the

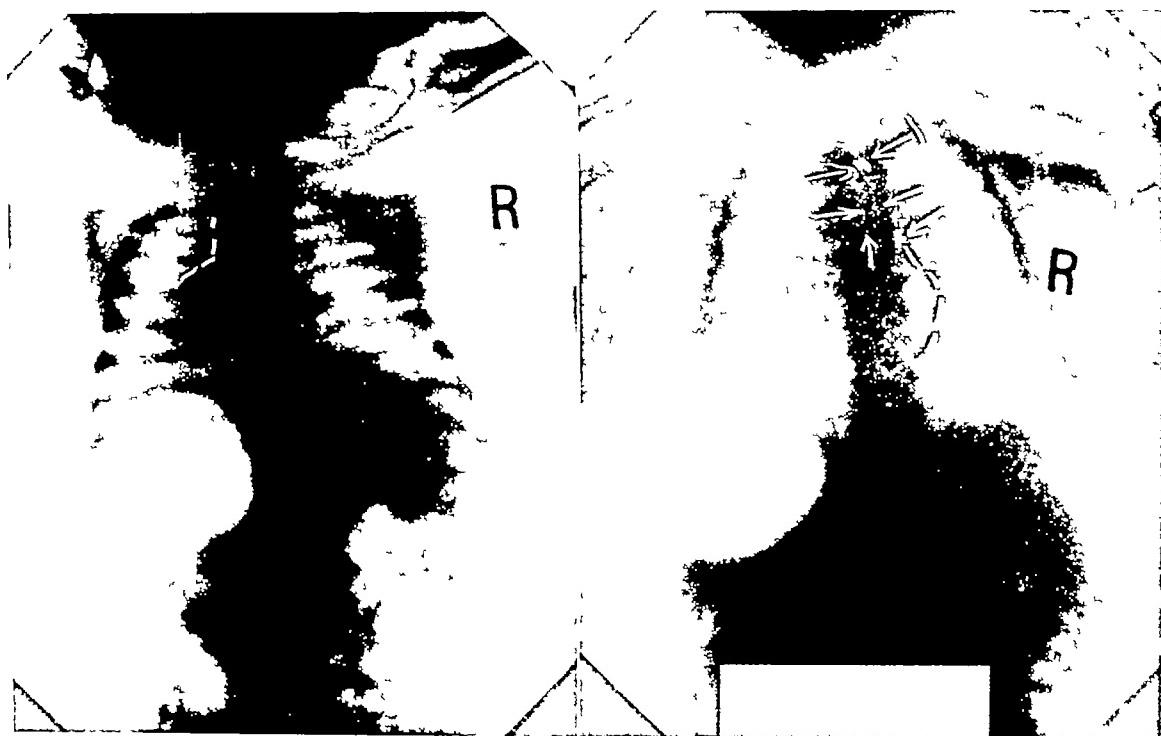


Fig 9 Thymic enlargement is toward the left

Fig 10 Enlargement is essentially to the right.



Fig 11 Marked bilateral enlargement

Fig 12 Same case as shown in Figure 11,
three months after treatment.

lumen of the trachea. The walls of this ridge enlarge toward the anterior wall of the trachea into a more or less triangular surface which is designated as the "anterior spur triangle", toward the posterior wall the edges of the

the outer angle which corresponds to the division of the bronchi

Out of the 125 human tracheæ investigated, the spur was found to be cartilaginous in 56 per cent, membranous in 33



Fig 13 Note the enlargement present

ridge diverge less, and there thus arises a small triangular surface of more or less inclination, called the "posterior spur triangle". The middle part of the spur connects these two surfaces with one another.

In the majority of the tracheæ studied, it is the plate of cartilage corresponding to the last tracheal ring, or a cartilaginous process of the last tracheal ring, which enters into the spur. In these cases the spur was designated as "cartilaginous-tracheal".

It was often difficult to determine whether bronchial cartilages or tracheal cartilages entered into the formation of the spur. The usual distinction of a spur as bronchial or tracheal was to recognize whether the respective cartilage rings lay above or below

per cent, partly membranous and partly cartilaginous in 11 per cent, in 21 per cent it was bronchial, divided as follows—15 per cent bronchial right, 3 per cent bronchial left, and 35 per cent double bronchial

The possibilities of compression are greater in those cases in which the tracheal rings are mechanically impaired.

Friedleben's studies in 1858 leaned largely toward the direct pressure theory and gave rise to the large controversial literature which exists to-day. That mechanical factors are concerned in some cases seems undeniable, but alone they by no means offer a wholly adequate or satisfactory solution, and the sudden arrest of the heart must be accounted for by some complex nervous-toxic mechanism which up to the p



Fig 14 Same case as shown in Figure 13,
lateral film Note tracheal compression



Fig 15 Same case as shown in Figure 13, six
weeks after treatment

has not been satisfactorily explained. The early pathologic findings of hyperthyroidism are equally mystifying, although varied therapeutic interferences are used with varying degrees of success, in spite of the inability to advance a rational explanation of the mechanism of cause and effect. This thesis so far is presented to orient the pressure theory.

It is appropriate to mention the physiologic functions advanced by different authorities:

(1) Thymectomy has no effect on growth and development of skeleton or organ

(2) Thymus feeding to salamander larvae, with parathyroid, causes tetanus

(3) Thymic hyperplasia in thyrotoxicosis is secondary

(4) In birds, a relationship exists between the thymus and the egg-laying mechanism

(5) One, if not the primary, function

of the thymus gland is to produce leukocytes

(6) The thymus may have antitoxic function

(7) Thymic death, not due to tracheostenosis, probably bears no relation to the state of the thymus gland

(8) Thymic hyperplasia in thyrotoxicosis is secondary

(9) A substance is contained in the thymus, which, when injected, causes convulsions

(10) Castration delays involution of the thymus

(11) The thymus is not necessary to life

It is known that the gland is a temporary or transitory organ of extra-uterine life, attaining its largest size at or soon after birth, and that it exists under three or four morphologic conditions.

We now enter the realm of roentgenology. Wasson, making serial roentgen-

ograms and serial physical examinations from birth to the age of three years, has made a thorough study of a group of chil-

dren. From roentgenologic and necropsy studies, he concluded that the two auricles and the great vessels form the base of the

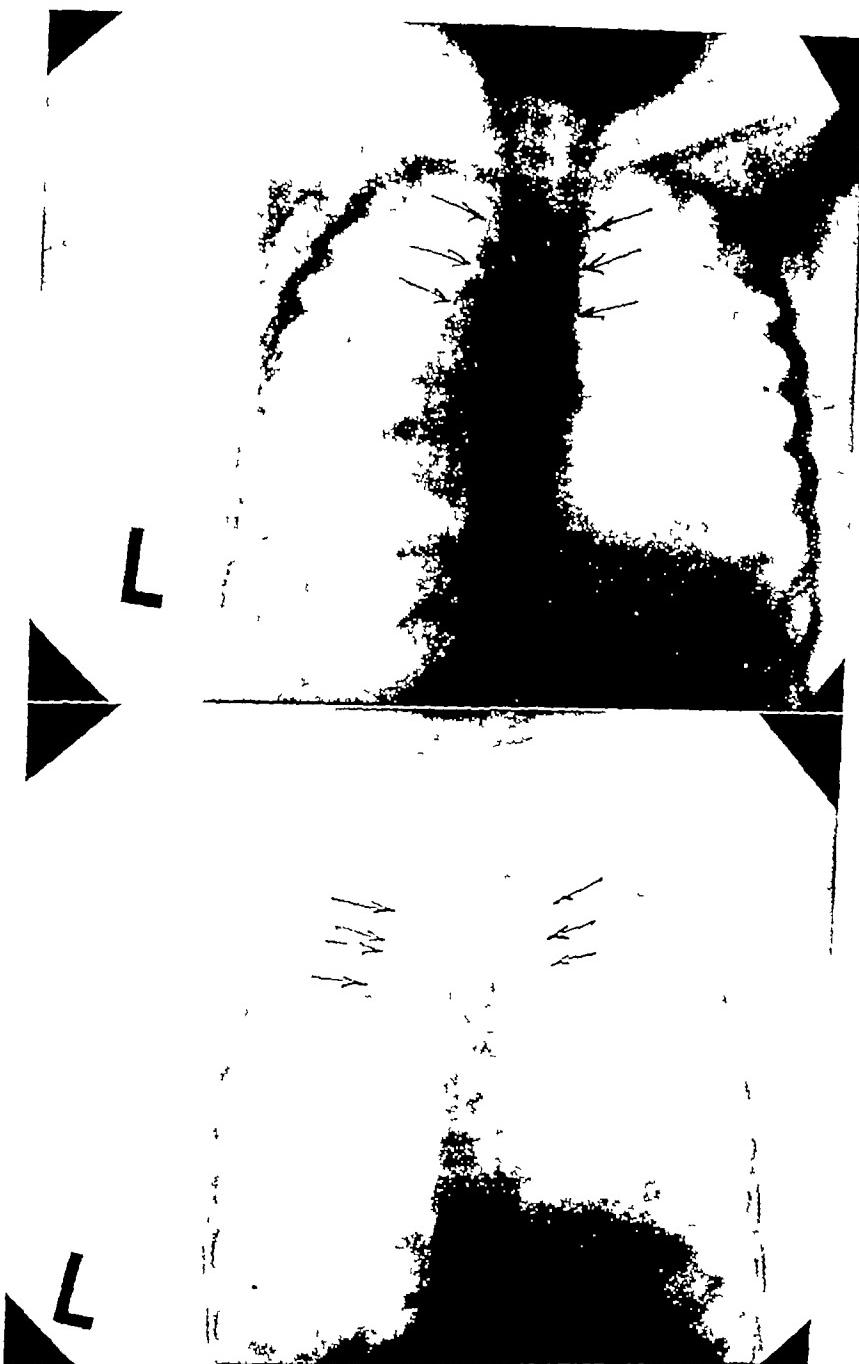


Fig. 16 (*upper*) Film after deep inspiration showing the mediastinal shadow. Compare with Figure 17, taken after deep expiration.

Fig. 17 (*lower*) Note transverse increase in mediastinal shadow, some of which is probably due to flattening or a large thymus. The thymus, in this instance, is increased in depth and manifest only after expiration.

heart shadow, the aorta, which lies in the middle of the mediastinum, in the new-born infant is not seen as a distinct shadow because of its position. It passes directly up, turns directly back, and passes down behind the heart, it is only in later life that it forms the typical aortic arch seen in adults.

If there is no sizable thymus present, the great vessels, the vena cava, aorta, and pulmonary artery, form a shadow, triangular in shape, which quickly narrows as it passes upward toward the first rib, and at its narrowest point is less than the transverse diameter of the shadow of the spinal column. If the thymus is considerably enlarged, it will be found to overlap the base of the heart, obscuring the shadow just described by the great vessels. The shadow of this thymus is triangular in shape, with its base overlapping the base of the heart and especially the auricles. Its transverse diameter at its broadest point, which is usually the third interspace, may be two or three times the diameter of the shadow cast by the thoracic spine. This shadow of the thoracic spine is taken by measuring the diameter of the vertebral body. If the shadow of the thymus is no greater than that cast by the great vessels, it is a small thymus. This applies only when the roentgenograms are taken in the postero-antero-recumbent position. The usual normal thymic shadow is about one and one-third times that of the vertebrae. Wasson concludes that, in infants under two years of age, the thymus is variable in size, not only in different types of infants, but in the same infant at different times. These thymuses may be classified as to size, and it is fairly definitely established that underweight infants have small thymuses, and those who are overweight have large thymuses. While the average-weight infant usually has a moderate sized thymus, this does not adhere so strictly to the rules. There is an increase in the thymus from birth to one year of age, it then reduces in size noticeably up to the

thirty-second month. Wasson calls this the thymic cycle.

Whenever possible, it is desirable to make a lateral projection in order to note a possible compression of the trachea, but, because of the infant's intractability, this cannot always be done. It is well to take a film after inspiration and another after expiration, however, infants are incapable of understanding co-operation and, therefore, ordinarily the examination must of necessity be limited. These films might show a comparative spread of the thymus, which is occasionally greatly increased if the thymus should be large in its anteroposterior dimension, the increase being shown in the film taken after expiration.

The question of a differential diagnosis is to be considered and the help of a pediatrician is of inestimable value. Confusion arises with the following simulants: congenital heart disease, meningitis, whooping cough, asthma, adenoids, congenital atelectasis, recurrent laryngeal paralysis, laryngeal stenosis, tracheal stenosis, retropharyngeal abscess, and foreign bodies.

The clinical evidences of thymic enlargement, such as transitory cyanosis, dyspnea, croupy cough, choking, and breath-holding, are common in these conditions, therefore care is necessary in the selection of remedial measures.

Lange, in 1911, made quite an exhaustive report on the roentgenologic treatment of enlarged thymus. Since then, X-ray treatment has been practised with apparently good results, as a matter of fact, no other form of satisfactory treatment has supplanted it. Singularly enough, because the structure is predominantly lymphatic, it is highly susceptible to light doses of X-ray.

Since it is always desirable to establish the safety of any therapeutics, Barnes, in 1929, made a study of 63 children who had received treatment from three and one-half to eight years previously, but he failed to demonstrate any constant deviation from

normal, either mental or physical. The dosages used, while somewhat high, in the light of our present knowledge, were apparently within the range of safety.

Treatment.—There is no need to apply larger doses than necessary and a certain amount of judgment in deciding the factors is desirable. In practically no instance is it necessary to give over one-quarter of an erythema dose at one time, usually one-sixth, or occasionally one-eighth, of an erythema dose may be indicated at one time. In the average case, three treatments are given, about two or three weeks apart. In this way involution is gradual and increased symptoms due to engorgement and toxemia are avoided. In rare instances, eight treatments are necessary. The writer had two instances in which an early X-ray examination, made as a precautionary measure, was negative, but several months later symptoms and re-examination revealed the presence of a large thymus. In both cases X-ray therapy abated the symptoms. These cases indicated that a latent or delayed pathologic thymus may exist.

The larger the thymus, usually the smaller the dose, also, the greater the evidences of inanition, the smaller the dose. While it is desirable to make repeated X-ray films at monthly intervals, the sole criterion is the evidence of improvement, which is remarkably obvious within from a few days to a few weeks.

The technical factors are 110 K V peak, 5 ma, + mm aluminum filtration, and two variables, namely, time and skin focal distance.

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X-RAY TREATMENT IN GYNECOMASTIA

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GYNECOMASTIA has been under discussion since the days of Aristotle (1) and many theories have been advanced concerning its causation. Up to the present time, however, none has proved satisfactory. Some of the most comprehensive early articles on this subject were written by Gruber (2), Laurent (3), Olphan (4), and Schuchardt (5).

Gynecomastia implies swelling of the male breast, which may be diffuse, local, unilateral, or bilateral. Clinically, gynecomastia may be divided into diffuse and local (fibro-adenoma) hypertrophies either may be unilateral or bilateral. Pathologically the local and the diffuse hyperplasias cannot be separated, for the early picture of hyperplasia gradually changes into fibro-adenoma. In other words, the young periductal fibroblastic tissue, present in early hyperplasia, gradually condenses and in time becomes a dense fibrous stroma which is typical of fibro-adenoma. This conclusion was reached after studying eighty-eight cases of gynecomastia, including a correlation of history, physical, laboratory findings, and a follow-up of the cases. The microscopic sections were compared to those of female breasts suffering from similar conditions. This study will be reported in another paper.

The first authentic report regarding treatment of swelling of the male breast was advanced in 1556 by Paulus Aegineta (7), who advised surgical removal. Since the majority of the cases are symptomless and complain only of deformity, treatment is seldom sought. However, the disfigurement has been responsible, in the case of some sensitive patients, for attempts at self-amputa-

tation, in an effort to be rid of the shameful swelling. Christopherson (8), in 1904, called attention to a boy who was so despondent over his affliction that he attempted self-mutilation. When seen, he had amputated one breast and, losing courage and strength, had only partially amputated the other breast. In 1837, Petrequin (9) reported a case in which the patient's mortification was the direct cause for amputation of both breasts. From the beginning of the nineteenth century it had not been uncommon to amputate one or both breasts for the deformity associated with gynecomastia.

In addition to deformity, pain is sometimes a complaint of gynecomasts, and although treatment for this symptom has not been as radical, patients have frequently subjected themselves to amputation in an effort to eliminate this sensation.

In 1922, Loederich and LeGoff (10) used radiotherapy in a 76-year-old patient suffering from an enlarged, tender, and painful breast. They reported a complete disappearance of pain, considerable decrease of tenderness, and a marked diminution in the size of the gland, following this treatment.

Because so little is known of the effect of X-ray treatment in gynecomastia and since such an excellent result was obtained in one of the author's cases, the following case reports are presented with the hope that they will bring to light another method of combating this clinical entity.

CASE REPORTS

Case 1. The patient was a white male, aged 12, who came to the hospital complaining of an enlarged right breast, which for the past few days had caused pain. In Sep-



Fig 1. Case 1. A white male 12 years of age showing a diffuse enlargement of the right breast of seven months' duration.

tember, 1922, he first noticed a gradual, diffuse, painless swelling, about three inches in diameter, of the right breast, which gave the sensation of fullness. Seven months later, and one week previous to examination, the patient traumatized his right breast while playing and this was followed by a diffuse "pin point discomfort" which lasted three days. Four days later, on April 19, 1923, the patient presented himself for examination (Fig 1). Previous to this the patient had not suffered from any sudden enlargement, disappearing tumefaction, or nipple discharge. No symptoms were noted in the left breast.

The past and family histories were essentially negative.

Physical examination showed a distinct, diffuse enlargement of the right breast, with

no visible lesions. Palpation revealed this enlargement to be free from the skin and the underlying tissues. There were no palpable masses and no enlargement of the axillary glands. The genitalia were normally developed for a boy of his age. The rest of the physical examination, including the left breast, was essentially negative.

Laboratory Examination—The X-ray examination showed no evidence of lung metastasis. The Wassermann test and complete blood examination were negative. A urinalysis revealed a specific gravity of 1.004, a trace of albumin, and an occasional pus cell. The blood pressure was 90/30.

Treatment—Three X-ray treatments were administered at intervals of two weeks. In each treatment the following procedure was adopted. Area over right breast, anteriorly, one-half hour, 175 K V, 5 ma., filter of 1 mm copper and 1 mm aluminum, 22-inch focal distance.

Progress Notes—Following each treatment a perceptible decrease in the size of the right breast was noted. This decrease in size was so marked after the third treatment that irradiation was discontinued. For the following four months the patient was seen once a month and each time the right breast was noticeably smaller. Four months after the last treatment the swelling had practically disappeared.

On October 26, 1931, eight and one-half years after the last X-ray treatment, the patient was examined by the author (Figs 2-A and 2-B). Since his last examination he has noticed no swelling nor has he felt any pain or discomfort. He had been entirely oblivious to his former affliction until recent communications reminded him of it. Physical examination at this time revealed the right breast to be identical with the normal left breast. No visible lesion, discharge, nipple retraction, or swelling was noted. Palpation revealed no glandular or soft part enlargement beneath the nipple.

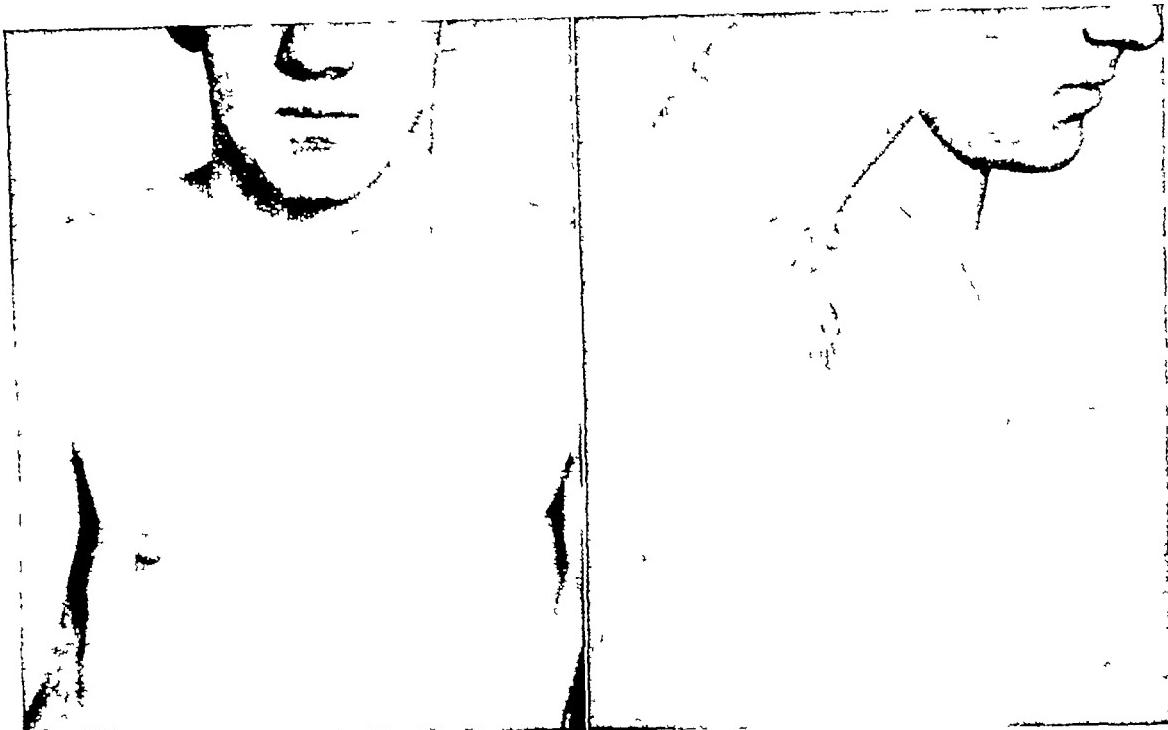


Fig 2-A Case 1 Anterior view of the patient shown in Fig 1, eight and one-half years after the last administration of irradiation by deep X-rays, showing an absence of gynecomastia

Fig 2-B Case 1 Lateral view of the patient shown in Figure 2-A

The remainder of the physical examination, including the genitalia, was essentially negative except for a beardless face and a moderately high pitched voice, neither of which is uncommon at 20 years of age

Case 2 The patient, a white male, 23 years of age, accidentally noted tenderness and a small mass about two centimeters in diameter, posterior to his left nipple. The mass for the first few months fluctuated in size and tenderness, but for the following two and one-half years there was a gradual increase in size, with no change in tenderness. Approximately three years after the onset nine treatments of deep X-ray were given on nine successive days, the total amount being similar to that used in Case 1. For the first three weeks following treatment the patient thought that there was an improvement in his condition. However, after the first month, the gradual growth

and constant tenderness were again noted. One year following X-ray treatment, the patient presented himself for examination. At that time inspection revealed a fullness of the left nipple. On palpation a firm, slightly tender, freely movable mass about five centimeters in diameter, posterior to the left nipple, was found.

Laboratory Examination—The X-ray examination was negative. The blood and urine examinations were negative.

Operation—A complete excision of the areola and glandular mass was performed.

Post-operative Findings—The patient made an uneventful recovery. To-day, eleven months later, this patient is living, with no recurrence of the tumor mass.

Gross Specimen—A circumscribed, bluish-white, firm mass posterior and inferior to the nipple, measuring $4 \times 3 \times 2$ centimeters was noted (Fig 3). Gross sec-



Fig 3 Case 2 Gross specimen of unilateral gynecomastia in a white male 23 years of age, showing a mass, posterior and inferior to the nipple, which had been present for three years. This breast had received irradiation for a nine-day period.

tion (Fig 4) revealed dense fibrous striations through which bluish-white tissue projected. Occasional yellow opacities were also seen.

Microscopic Section—The tissue revealed



Fig 4 Case 2 Cross-section of specimen shown in Figure 3, showing dense fibrous striations through which bluish-white tissue projects

a mild hyperplasia of the duct parenchyma, with a slight tendency toward cell atrophy (Fig 5). In areas, slight desquamation into the duct lumen was present. The periductal as well as the interductal fibrous stroma was dense, being composed of adult and well formed fibroblasts. In the periductal stroma



Fig 5 Case 2 Microscopic section of the specimen shown in Figure 3. It presents an adult fibrous periductal stroma and a slight atrophy of the hyperplastic duct epithelium.

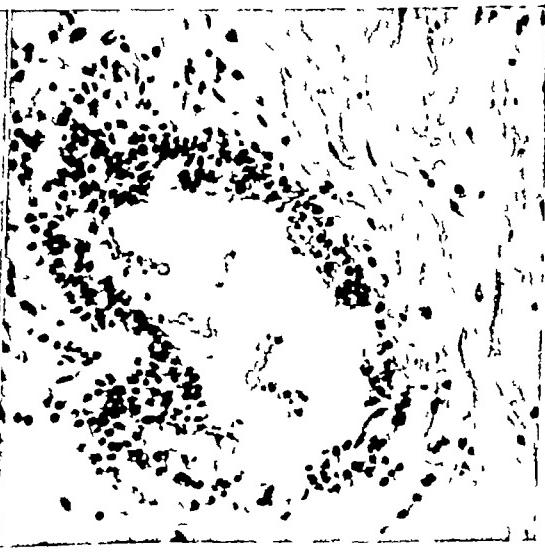


Fig 6 Case 4 Microscopic section of a white male 44 years of age showing atrophy, desquamation, and breaking up of the parenchymal cells lining the duct lumen. The breast of this patient received irradiation by deep X-rays (Compare with Figure 7)



Fig 7 Microscopic section of a normal, non-irradiated breast taken from a 65-year-old male showing desquamation, atrophy, and a breaking up of the parenchymal cells lining the duct lumen

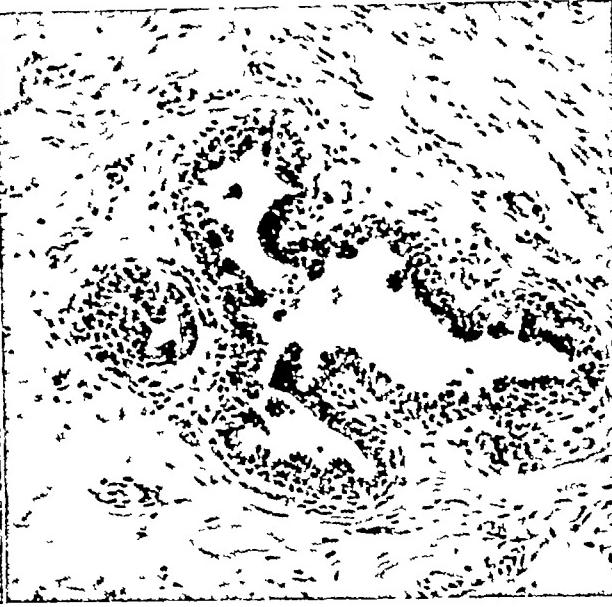


Fig 8 Microscopic picture of gynecomastia occurring in a white male 17 years of age, showing hyperplasia of intact parenchymal cells lining the duct lumen and surrounded by a dense fibrous stroma. This case was not irradiated and is shown only for comparison (See Figures 6 and 7)

mild lymphocytic infiltration was occasionally seen

Case 3 Six weeks previous to examination the patient first noticed a "small lump" in his right breast and a needlelike pain, originating in his right nipple whenever it was touched. No improvement was noted. Four weeks later, he was given one deep X-ray treatment by his physician.

Physical examination revealed a poorly developed, white male, 67 years of age. The right areola was slightly more prominent than the left. On palpation a circumscribed, freely movable, slightly tender mass about five millimeters in diameter, in the upper outer quadrant of the right breast, was noted. The remainder of the physical examination was negative.

Laboratory Examination—The X-ray examination was negative. Both the blood and urine examinations were negative.

Operation—The areola and tumor mass were completely excised.

Result—The patient died fifteen months later from "bladder inflammation."

The gross and microscopic sections are similar to those of Case 2.

Case 4 Four months previous to examination the patient noted tenderness and a small "lump" below his right nipple, both of which gradually increased for three months. At the end of this time, he was given X-ray treatment by his physician, but the tenderness and swelling persisted.

Physical examination revealed a white male, age 44. The right nipple was slightly higher than the left.

On palpation a flat, definite, indurated mass about two centimeters in diameter was found, attached to the nipple but not to the underlying structures. The remainder of the physical examination was negative.

Operation—The right breast was amputated.

The gross specimen presented a firm, fibrous, tumor mass, posterior to a normal

nipple, with ill-defined edges measuring from one and a half to two centimeters

The microscopic section showed a duct hyperplasia with desquamated cells in its lumen and an apparent atrophy of the parenchymal cells (Fig 6) The stroma was dense and fibrous and contained a slight lymphoid infiltration in its periductal bed

Result—The patient could not be located five years later

DISCUSSION

In an effort to explain the result of X-ray treatment in gynecomastia one must first realize the presence of a hyperplasia of the parenchymal cells, together with a hyperplasia of the periductal, loose, young, connective tissue stroma in this condition This type of stroma is frequently seen in gynecomastia of short duration Irradiation seems to have a specific retarding effect on the growth of this young connective tissue element, as well as a tendency to produce atrophy of the parenchymal cells If the hypertrophy is maintained for a longer period of time, the young fibrous tissue condenses and becomes more mature X-ray treatment does not seem to have any effect on the maturing or matured fibrous hyperplasia

In Case 2 the mature fibrous element had already formed when X-ray treatment was given, consequently the total effect produced seemed to be a slight atrophy of the parenchyma

In Cases 3 and 4 the amount of X-ray treatment given is not known The lapse of time between treatment and operation was too limited to justify a conclusion that the results were poor However, the microscopic picture in both cases offers an explanation by presenting an adult stroma and an atrophy of the parenchymal duct cells

TREATMENT

In all probability the first treatment used in tumefaction of the male breast was rest

and advice not to manipulate the part This was the natural result of the limited knowledge of gynecomastia that prevailed at the time

Up to the present time, the accepted treatment for cases of gynecomastia has been to leave them alone If pain is not relieved by suggestive and palliative measures, and if the deformity is a constant source of mental anxiety, amputation is considered

In view of the findings recorded, X-ray irradiation should be resorted to in all cases of gynecomastia of short duration Best results seem to be obtained in the diffuse enlargements in cases in which the young periductal fibrous tissue is in abundance After X-ray treatment has been given a fair trial, if the results are found to be unsatisfactory a more radical procedure is to be considered Deaver and McFarland (11) are of the opinion that amputation of the breast or breasts, affords the only lasting benefit in gynecomastia

CONCLUSIONS

- 1 Gynecomastia may be local, diffuse, unilateral, or bilateral
- 2 The hyperplasia of gynecomastia gradually changes into the so-called fibroadenoma
- 3 The early hyperplasia in gynecomastia seems to be sensitive to X-ray irradiation

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Way Nerves Act on Muscles Discovered—The mechanism by which a nerve impulse can be converted into a chemical stimulus has been indicated in studies reported by Prof Walter B Cannon, of Harvard Medical School, to the Association for the Study of Internal Secretion Prof Cannon described his newly discovered hormone, sympathin, which is found very generally in smooth muscle tissue It is probably the same as

adrenalin, the stimulating secretion of part of the adrenal glands The action of the two substances—sympathin and adrenalin—is apparently very similar

The discovery of sympathin is expected to have great practical importance Secretion of sympathin from a muscle cell upon stimulation by a nervous impulse may be the way in which the nerve impulse can cause activity of tissue—*Science Service*

DIRECT COMPUTATION OF DEPTH INTENSITY

By KENNETH S COLE, PH.D., Department of Physiology, Columbia University, and
Roentgen-ray Department, Presbyterian Hospital, NEW YORK

IN DEEP therapy, sufficient radiation should be absorbed by the tissue under treatment to give the desired effect without there being enough radiation absorbed at the skin to produce a severe reaction. If treatments are to be put on a quantitative basis, it is then necessary to know the amounts of radiation absorbed—preferably expressed in r units—at both skin and depth, so that the clinician may learn by experience what quantities are necessary to produce reactions at the skin and in various tumors. Thus it is important to be able to compute the depth intensity simply and easily.

Most, if not all, published phantom measurements give intensities of radiation relative to the intensity at some point in the phantom. This point is usually at the surface for some arbitrary area of field. If we then wish to use these measurements to find the intensity at a certain depth, we must measure the intensity for at least one point in a phantom. Since water phantom measurements are inconvenient at the best, it seemed expedient to make them once and for all in terms of the intensity of the radiation as measured in air without back-scattering at the skin-target distance.

The X-ray tube was operated at 200 KV,

TABLE I

| Filter 1 mm Al + mm Cu | Intensity r/min |
|------------------------------|--------------------|
| 0.55 | 22.2 |
| 1.1 | 14.6 |
| 1.86 | 9.6 |
| 2.62 | 6.6 |

8 ma constant potential. At 50 cm it gave the copper filtration intensity data of Table I, without back-scatter. Table II gives the percentages of the intensity in air which are found for different depths, fields, and filters. The very striking result is that, for any given filter, field, and depth, the phantom intensity is always a constant percentage of the air intensity for the same filter—no matter if it be 0.55 mm or 2.62 millimeters. For convenience this percentage is called the phantom factor or ratio. In Table III the data from Table II at 10 cm depth and different fields are compared with those of Failla and Quimby (Table XVI and Figure 8).¹ The agreement is good enough to justify the use of Failla and Quimby's data in computing the phantom factor for different fields at the other depths from the

¹G. Failla and E. H. Quimby, Am. Jour. Roentgenol. and Rad. Ther., December 1923, p. 944-967.

TABLE II

| Filter 1 mm Al + mm Cu | Air Intensity 50 cm. | Phantom Intensity | | | | | | | | | |
|------------------------------|----------------------------|-------------------|---------|---------|-------|---------------|------|----|-----|-----|-----|
| | | 10 cm depth | | | | 15 X 15 field | | | | | |
| | | 20 X 20 | 15 X 15 | 10 X 10 | 6 X 8 | 10 cm | 8 | 6 | 4 | 3 | 2 |
| 0.55 | 100 | 47.7 | 45.0 | 35.3 | 25.8 | 45.0 | 62 | 79 | 100 | 102 | 105 |
| 1.1 | 100 | 49.8 | 45.0 | 35.8 | 26.8 | 45.0 | 63 | 79 | 100 | 102 | 105 |
| 1.86 | 100 | 48.6 | 41.6 | 34.8 | 27.2 | 41.6 | 60 | 80 | 100 | 102 | 105 |
| 2.41 | 100 | — | — | 35.2 | — | — | — | — | — | — | — |
| 2.62 | 100 | 48.3 | 43.6 | — | 26.6 | 43.6 | 61 | 83 | 103 | 105 | 105 |
| Average | 100 | 48.6 | 43.6 | 35.3 | 26.6 | 43.6 | 61.5 | 80 | 101 | 103 | 105 |

depth data with 225 sq cm field. These results are given in Figure 1.

0.55 mm and 2.62 mm copper. Conversely, this phantom factor should be independent

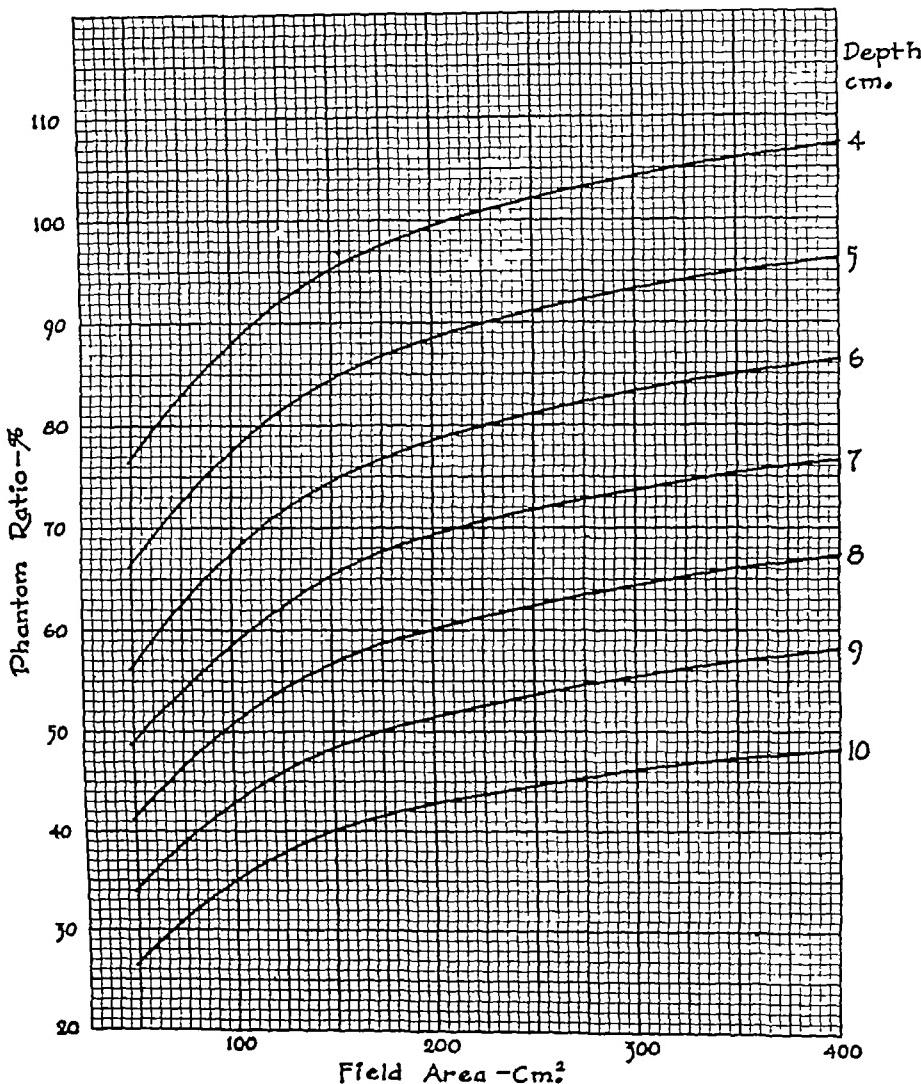


Fig. 1

The set of curves shown in Figure 1 make it surprisingly simple to compute the amount of radiation absorbed by any underlying tissue. Let us suppose that 600 r (measured in air) have been given over a skin area of 144 sq cm with 50 cm skin-target distance. We then know immediately that a tissue at a depth of 5 cm has absorbed 500 r since this phantom factor is 84 per cent from Figure 1. This result is the same when the 600 r is given with any filtration between

of the tube voltage for at least a limited range. This points to the interesting suggestion that the use of high voltage and heavy filtration is of slight value in giving

TABLE III

| Field | Table II | F-Q | Ratio |
|-------|----------|------|-------|
| 400 | 486 | 1.38 | 352 |
| 225 | 436 | 1.25 | 348 |
| 100 | 353 | 1.00 | 353 |
| 48 | .266 | 0.78 | 341 |

greater depth intensity. Suppose it is known in advance that a region 10 cm deep should have 350 r through a 315 sq cm field. From Figure 1 the phantom factor is 46.5 per cent, so 750 r (measured in air) must be given. It now remains to choose such filter and voltage that 750 r will not produce a skin reaction on the 315 sq cm field. Filter and voltage are the factors to be adjusted to protect the skin after the quantity of radiation (as measured in air) necessary to produce the desired depth intensity is known.

from clinical experience and the phantom factor.

Further measurements are planned to set the limits of voltage and filter on the phantom factor, to check the application of Failla and Quimby's inverse square relation to the phantom factor at other S.T.D., and to find the minimum depth at which the phantom factors may be used. It is obvious that their independence of wave length must fail at and near the surface since the usual depth dose is not independent of wave length.

List of All Science Journals being Compiled in England—British scientists are now listing all the periodicals of science. A new edition of the "World List of Scientific

Periodicals," the first edition of which contained titles of some 24,000 periodicals, is to be issued soon. The editor is W. A. Smith of the British Museum—*Science Service*.

SYSTEMIC BLASTOMYCOSIS, WITH REPORT OF A FATAL CASE

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CASES of systemic blastomycosis, though the disease is fairly widespread, are still not very common. In spite of the excellent reviews on the subject and the many cases of systemic blastomycosis which have been reported in the various medical journals, it seems to us that our case, studied from clinical, roentgenologic, bacteriologic, and histopathologic points of view, warrants its publication.

At the Rochester General Hospital two cases of systemic blastomycosis have been seen within the last three years. The first one, in which a hen's-egg-sized tumor of the leptomeninges was removed from a 52-year-old white male, was a so-called primary meningeal form and has been reported elsewhere. The tumor showed a great number of budding organisms and a characteristic microscopic picture; however, the case was not entirely conclusive because only histologic examination was done. Cultures could not be prepared and autopsy was not obtained. The second case of systemic blastomycosis with multiple foci was observed during 1930. At the time of the patient's admission only a few lesions were found, nevertheless the correct diagnosis was established in a few weeks, thus determining the available treatment and the poor prognosis. The case is as follows:

CASE REPORT

C. P., male, Italian parentage, aged 19 years, entered the hospital Feb. 22, 1930, with the following chief complaints: (1) sores on right foot and right wrist; (2) swellings of knees; (3) weakness. The family history was irrelevant.

Past History.—The patient was born in, and has always lived in, New York State. He was in the Rochester State Hospital from Sept. 30, 1928, to April 26, 1929, with the diagnosis of dementia praecox. No history of past diseases or symptoms was obtained on searching inquiry. He had been unemployed for some time, though he had previously worked in a grocery store. Most of the history of his present illness was obtained from the family, who had considered the patient physically well until December, 1929. During that month, after a slight trauma, the patient noticed a sore on the right foot, with accompanying fever. The lesion was incised and "pus" obtained; however, drainage of the thin fluid was continuous. The right, and later the left, knee became swollen and painful. Swellings and later ulcerations of the right ankle and right wrist were noted. Fever of varying degrees had been present since the beginning of the illness. Progressive weakness and a loss of ten pounds were experienced. There had been an occasional cough and on one or two occasions a small amount of blood-tinged sputum was expectorated. No gastro-intestinal or genito-urinary symptoms were present. There was no change in the mental state.

Physical Examination.—Physical examination revealed that the patient was well developed, but poorly nourished, with an appearance of chronic illness. The skin was yellow, with numerous acneform lesions over the face and chest, and the general hygiene was poor. The patient possessed a grinning face, and talked in a foolish way, giving irrelevant answers. He was dull, uninterested, and unable to discuss his condition.

Examination of the eyes showed that the right pupil was larger than the left, both reacted sluggishly to light and accommodation. The fundi were negative.

Throat and mouth Considerable post-

Heart Blood pressure, 120/80. The apex was at the fifth intercostal space, 10 cm to the left of the midsternal line. Rhythm was regular and there were no murmurs.

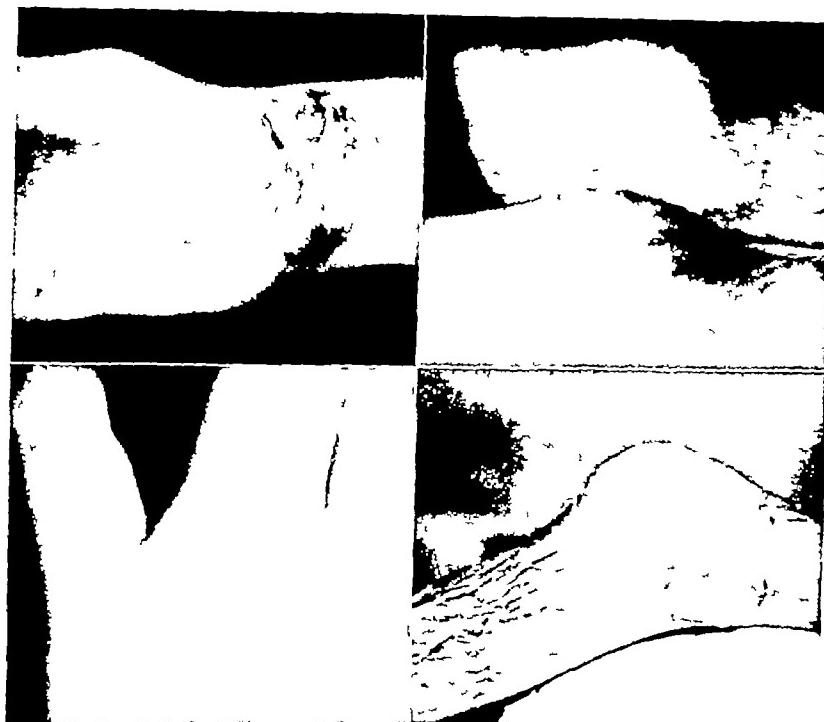


Fig 1 (upper left) Two pigmented swellings of the flexor surface of the right wrist. One of the swellings has already become ulcerated.

Fig 2 (upper right) Swelling of the knees during the first months of involvement of the knee joints.

Fig 3 (lower left) A pigmented swelling over the first metacarpal bone of the left fourth finger which later became ulcerated.

Fig 4 (lower right) The left knee joint denuded of the covering skin during the latter part of the disease.

nasal discharge was present. The tonsils were enlarged and very cryptic. One or two carious teeth were present. The tongue was white-coated and dry.

Chest The expansion was fair, but the right chest lagged on inspiration.

Lungs On the right there was relative dullness over the first, second, and third intercostal spaces anteriorly and posteriorly, with diminution in breath sounds anteriorly. The voice sounds were slightly increased. No râles were heard.

Abdomen The spleen was palpable.

Extremities On the dorsum of the right hand there was a large, brownish-blue, pigmented area with two ulcers showing well defined borders, from these came a sero-sanguineous fluid. Anterior to the wrist were two pigmented fluctuant swellings (Fig 1). Over the dorsum of the right foot there were two irregular ulcers 3 cm in diameter, the skin about these areas being pigmented and the same thin fluid being present. There were two small swellings



Fig 5 Abscesses on the scalp

about the external malleolus. Both knees presented moderate effusion, but no discolorations were noted (Fig 2)

Laboratory Studies—The admission blood count was red blood cells 4,160,000, white blood cells, 11,000, hemoglobin, 80 per cent (Sahli). These lowered slowly until the last count showed red blood cells, 2,600,000, white blood cells, 7,800, hemoglobin, 40 per cent (Sahli).

Smears Neutrophils 80, eosinophils 2, large lymphocytes 1, small lymphocytes 17 per cent. The bleeding time was two minutes, clotting time, three minutes. The blood Wassermann test was negative. The urine occasionally showed a 1+ albumin and a few white blood cells.

Progress—The patient was in the hospital seven months, during which time there was a slow but steady progression of the disease with little tendency to remission. There was a gradual loss in strength, appetite, and weight, until a state of extreme emaciation was reached. The patient complained of headaches and joint pains. His temperature remained above normal during the entire course and during later stages reached 104° F or more. At times a systolic murmur was heard at the base of the heart. The mental status remained unchanged until the later weeks, when he developed delusions of fear.

Locally, lesions developed in succession on the left ankle, left hand (Fig 3), lower back, right forearm, left wrist, knees (Fig 4), over the sternum, upper back, scalp (Fig 5), etc., until the patient was literally riddled with them. It was characteristic that at first a fluctuant swelling appeared which later became pigmented and ruptured unless incised (practically all were). These lesions then continued to drain the serosanguineous fluid which was released. Coincident with each early swelling, X-ray examination always showed typical bony change with rupture of the periosteum, and subcutaneous tissue and skin manifestations. As each individual lesion progressed in size, the skin seemed to "melt" away, leaving large denuded areas.

The treatment consisted of general supportive measures with sedatives and palliatives. Local lesions were widely incised as soon as the first swellings were noted. The knees were aspirated. Wet dressings of 1 per cent copper sulphate and acriflavine were used, and large doses of potassium iodide were given orally and intravenously. Early in the illness one transfusion was given. Weekly neo-arsphenamine was tried. A vaccine was made, but in view of the patient's poor condition it was not administered. X-ray therapy was considered, but in view of the extensiveness of the process, it was considered futile.

ROENTGEN-RAY FINDINGS

At different intervals, X-ray films were made of every bone of the body, but the observed lesions showed no predilection for any part of the skeleton. They were purely destructive throughout the course of the disease and were characterized by the lack of reparative and of periosteal reaction, clear-cut margins, their location in the cortex, lack of osteoporosis, their multiplicity, rapid development, and accompanying sinuses.

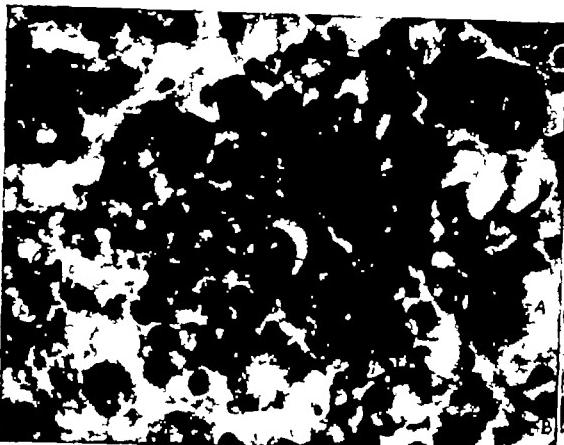


Fig. 6. A larger blastomycete (*A*) is being attacked by leukocytes (*B*)

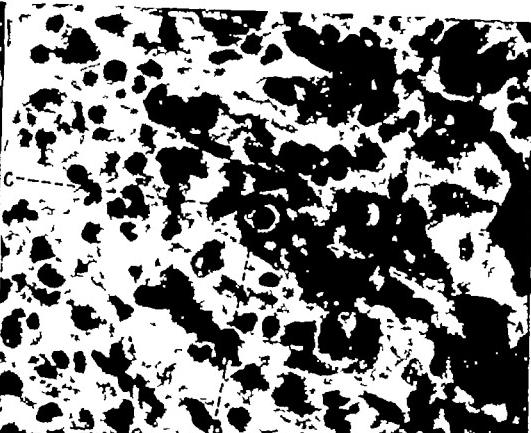


Fig. 7. A smaller budding organism (*A*) is engulfed by a mononuclear phagocytic cell (*B*). One or two other phagocytic cells (*C*) have joined very closely

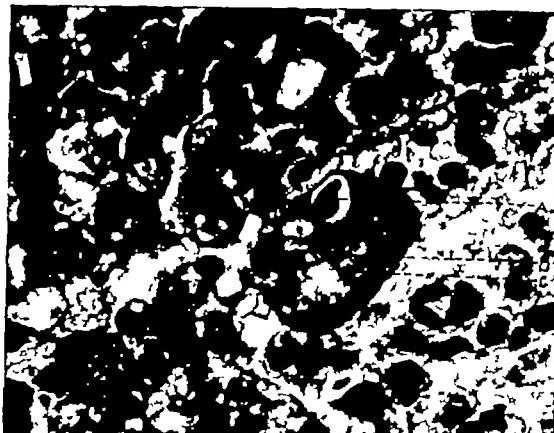


Fig. 8. A budding organism (*A*) in a foreign-body giant cell (*B*). The border of one of the composing phagocytic cells (*C*) is still suggested

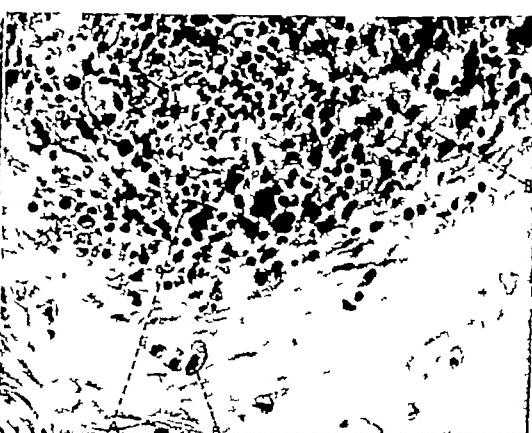


Fig. 9. The edge of an early lesion. Collection of leukocytes (*A*) and large mononuclear cells (*B*)

Lesions developed in the following bones multiple lesions of the bones of the vault of the skull (Fig. 13) involving both tables, the right acromion process, medial ends of both clavicles and the manubrium, condyles of the right humerus, upper end and shaft of the right ulna (Fig. 14), styloid process of the right radius (Fig. 15), the lower end and condyles of the left humerus, styloid process of the left radius, the crests of the iliae, the right greater trochanter, middle third of the left femur (Fig. 16), lower

third of the right femur, upper poles of both patellæ, right tibial tuberosity, right medial malleolus, distal ends of both first metatarsals (Fig. 17), and a marginal lesion of the eighth right rib.

In addition to the bone lesions, films of the chest at the time of admission revealed a consolidation of the right upper lobe which had the appearance of lobar pneumonia in an early stage of resolution. This lesion gradually cleared, until the last examination, made shortly before death, showed only a

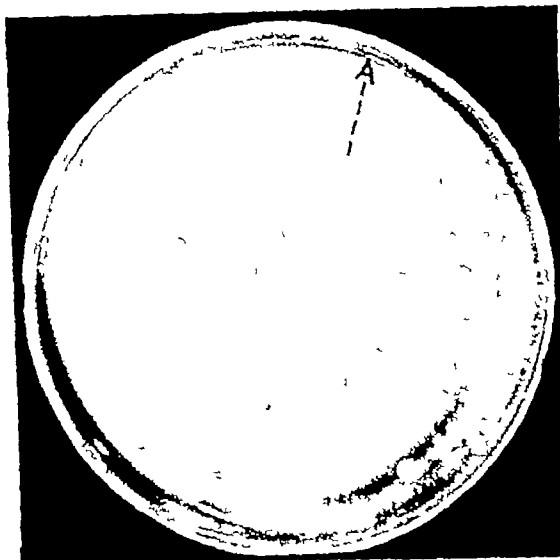


Fig 10. The colonies of the blastomycetes (*A*) on 2 per cent glucose agar

few lines of increased density radiating from the right hilum

BIOPSY

Soon after the patient's admission to the hospital, microscopic examination was done on a biopsy specimen which was obtained from a lesion which was just beginning to break through the skin from below, although the epidermis was still intact. In the corium and the subcutaneous connective tissue there was a lesion composed of numerous dilated blood vessels, delivering abundant polymorphonuclear leukocytes, furthermore hemorrhages, plump mononuclear cells with large, often foamy protoplasm and scattered masses of leukocytes, were disclosed. Blastomycetes, *viz.*, round bodies with highly refractive capsules, were disseminated throughout in moderate number. Their size varied a great deal up to 35μ in diameter. The large blastomycetes were usually attacked by leukocytes (Fig 6), while the small forms were taken up into mononuclear phagocytic cells (Fig 7). Other large phagocytic cells often joined to such a cell and, evidently, by their fusion the

foreign body giant cells developed (Fig 8). Such giant cells were found in a moderate number in this early lesion. Mitotic figures were observed in endothelial cells of blood vessels and in the mononuclear phagocytic cells outside of the vessels. Numerous phagocytic cells were packed with brown pigment granules which gave the iron reaction. This early lesion was not demarcated by a fibrous zone, the edge showing dilated vessels with numerous leukocytes and a gathering of large mononuclear cells in the tissue spaces (Fig 9).

Examination of a piece of the left iliac bone, removed at operation for an abscess of this region, showed that the bone abscess was walled off by a thin fibrous tissue containing abundant blastomycetes. The organisms were attacked by leukocytes, and minute abscesses were formed in the fibrous tissue. The neighboring bone marrow presented an accumulation of plasma cells and polymorphonuclear leukocytes, but no other remarkable changes. Pieces of bones removed at autopsy from bone lesions showed a similar picture.

BACTERIOLOGIC EXAMINATION

The first cultures were made on March 5 on Sabouraud's media and glucose agar from the open lesions on the right wrist. The colonies of blastomycetes appeared in from two to six days as pin-point sized, round, elevated, grayish spots soon showing radiating filaments. Some colonies were round for several days, bulging very much, firmly adherent, grayish, and only later on developing radiating filaments. As the colonies became older, they grew much larger, becoming one centimeter or more in diameter, and a great number of aerial hyphae developed, causing a fluffy appearance. The center of the colonies remained prominent (Fig 10). In glucose broth the growth was sluggish and fermentation was not obtained.

Microscopically the young colonies pre-

sented numerous septate mycelial filaments with true branching. The filaments showed granules. Round bodies could be found but they were scarce (Fig 11). In old, drying cultures the round bodies with refractile

organisms, but lesions could not be detected in any of the organs.

According to the above description, the isolated strain of blastomycetes belongs to the non-fermenting type described by Gilchrist

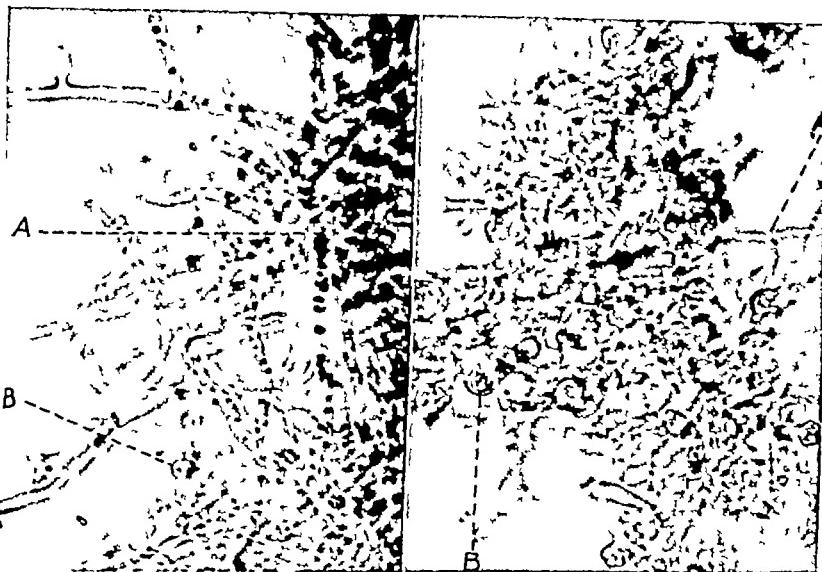


Fig 11 (*left*) Microscopic appearance of young colonies of blastomycetes. Numerous septate mycelial filaments (*A*) with true branching. There are only occasional round organisms (*B*).

Fig 12 (*right*) Older colonies under the microscope. There are mycelial filaments (*A*), but the round bodies (*B*) are abundant.

capsules were abundant (Fig 12). These drying cultures lost their fluffy character and appeared as velvety white colonies on glucose agar media.

Positive cultures were also obtained from the biopsy specimen and later on from a hip abscess and knee joint fluid. The peculiar brownish-red color and stringy consistency of the pus were noted. According to the histologic examination, the chocolate-brown color of the pus was due to the pigment found in the phagocytic cells. Cultures of blood, spinal fluid, sputum, urine, and feces were repeatedly negative for blastomycetes. The patient raised only a small amount of sputum.

A white mouse and a rabbit were injected subcutaneously and intravenously with a single dose of the emulsified colonies of the

(4) Castellani and Chalmers (2) classify these organisms under the name "odium."

POSTMORTEM EXAMINATION

An autopsy was performed a few hours after the patient's death on Sept 18, 1930 with the following findings. The skin of the extremely emaciated young man was pale and wrinkled and there were many ulcers covered with slough and a greenish discharge. A number of these were located on the scalp. An ulcer was located at the sternal end of the left clavicle and a sinus led from the bone to the surface. There were ulcerated areas over both knees, at the basis of which sinuses opened into the knee joints. The right knee showed two sinuses one on each side of the patella, the left knee



Fig 13. X-ray film of skull cap showing multiple lesions which involve both tables

one, on the outer side. The left wrist was ulcerated, especially over the distal end of the ulna, which was denuded of almost all soft-tissue covering except the extensor carpi ulnaris tendon that held it in place. Finally, there was a large ulcer over the sacrum.

The skull cap was perforated by two sinuses, and extensively eroded by a localized necrotic process which attacked the bone from both internal and external surfaces. In the left frontal region, a walnut-sized, extradural abscess was formed. The brain showed a corresponding depression. While the leptomeninges were thin, the brain itself showed no remarkable pathology on the surface or on the numerous frontal sections.

The inner surface of the manubrium sterni was carious, the discharge from this area being carried to the sinus at the sternal end of the left clavicle. The heart showed marked loss of epicardial fat, but otherwise the findings here were negative. The left pleura was smooth and glistening except an area 4 by 10 cm posterior to the lung root

where the left lung was adherent to the chest wall. Here the left lung was red but still crepitant. On cut section an increased amount of bloody fluid was expressed from this region. There was a small retropleural abscess due to a carious rib at this site. Another abscess was found, more lateral, and on a lower rib. The right pleura was smooth and the right lung was crepitant throughout, but its lower lobe was somewhat edematous. The fifth lumbar and the first sacral vertebrae were carious. The discharge drained posteriorly through a sinus described above.

Histologic examination of autopsy specimens showed areas of peribronchial fibrosis in the upper lobe of the right lung and atrophy, together with passive congestion of the liver. The other organs were not remarkable, except for the anemia and general atrophy. The lymph nodes were negative.

DISCUSSION

Systemic blastomycosis has presented lung lesions in about 90 per cent of the cases and, according to Stober (7), the pathology of the lungs consisted of old bronchopneumonic lesions. In our case X-ray examination of the lung showed a definite shadow which gradually cleared up. Sections of the lung from that region showed fibrosis of the peribronchial tissues and also of the alveolar wall, although no blastomycetes could be found. On the basis of these lung findings and in the absence of other convincing primary foci, we must also assume that probably the lung was the portal of entry of the blastomycetes.

Histologic observation showed that the blastomycetes were not digested either by the leukocytes or by the large phagocytic and the giant cells. It seems probable that the phagocytic cells, having engulfed the organisms would enter the blood stream and

sented numerous septate mycelial filaments with true branching. The filaments showed granules. Round bodies could be found but they were scarce (Fig 11). In old, drying cultures the round bodies with refractile

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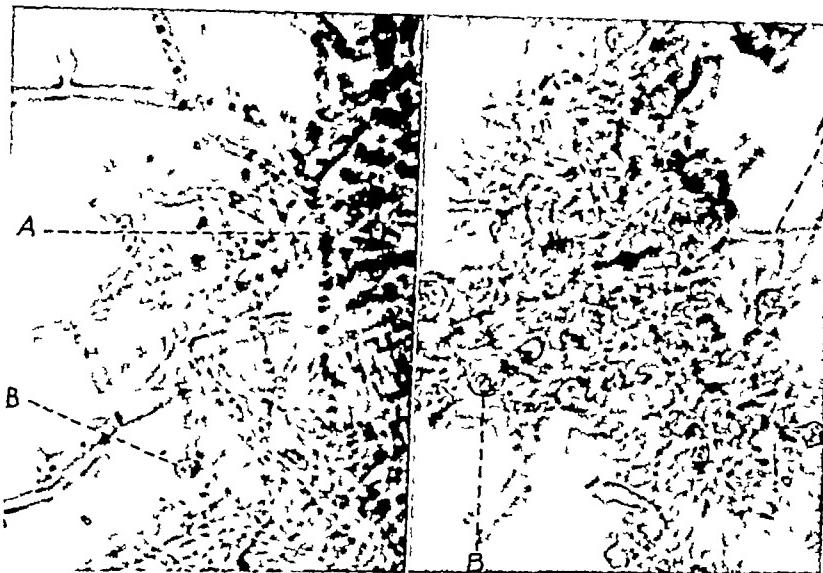


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Fig 18. Chest on admission, the lesion occupying the right upper lobe. The lines of increased density seem to radiate from the hilum and are apparently due to a peribronchial infiltration

Fig 19. Film made shortly before death. The lesion of the right upper lobe has practically disappeared

it seems also probable that the re-infection of the system from a bone lesion may occur and other foci may subsequently develop if demarcation by fibrosis is inadequate. Such a process occurred evidently in our case, for the new lesions appeared at intervals of several weeks. A cutaneous lesion cannot be considered as the primary focus of the infection because it is always associated with bone lesions from which the deeper tissues and the skin became involved. Brain lesions were not found at autopsy, though a few cases have been published in which cerebral and cerebellar abscesses are reported (5). In our case only an extradural abscess was observed as a result of a skull lesion.

Bacteriologic examination of the biopsy specimen and the pus obtained at operations gave positive results. The blastomycetes grew readily on 2 per cent glucose agar plates at room temperature and were usually associated with *Staphylococcus aureus*. The

latter was considered as a secondary invader and not as a contaminating organism. Other observers have also found various organisms as secondary invaders (8). The blastomycetes cultivated from the various lesions always showed the same type of growth. The colonies were white and fluffy, due to the abundant aerial hyphae as long as there was enough moisture in the culture media. As the culture media became rather dry, the aerial hyphae disappeared, and the colonies turned velvety with a slight light brown hue. These colonies showed only round bodies under the microscope.

Histologically the lesions were different from those caused by the tubercle bacilli. It is not our purpose to consider in detail the histologic characteristics of the blastomycotic lesions. The microscopic picture and the features distinguishing it from tuberculosis were emphasized among other authors by one of us (3) in an article reported else-



Fig. 14 (*upper left*) Showing lesions of shaft and condyles of the humerus

Fig. 15 (*upper right*) Right forearm showing lesions in the ulna and the styloid process of the radius

Fig. 16 (*lower left*) Showing lesions in the shafts of the femora and the greater trochanter of the right femur

Fig. 17 (*lower right*) Antero-posterior film of feet with lesions in the first metatarsals Note the absence of bone production in all the bone lesions

the lung would clear up, the remainder being but a slight fibrosis. The living organism would have ample time to multiply if lodged somewhere, especially in the bones. The

epiphyseal portions of the bones and the cancellous bone tissue appear to be favorable places for the phagocytized organisms to be easily caught up and retained. Furthermore,

multiple bone lesions which later involved the soft tissues above the bone and ulcers of different sizes developed

3 Blastomycetes were found in the lesions culturally and histologically. The diagnosis of systemic blastomycosis was established after a few weeks of hospitalization of the patient.

4 Characteristics of the isolated strain of blastomycetes and the histology of the early lesions are described.

5 X-ray appearances of the bone lesions are given and the possibility of differentiating blastomycosis and coccidioidal granuloma from other bone lesions is considered.

6 The primary focus of infection was considered to be in the right lung. This consideration was supported by X-ray findings, though toward the end of the patient's life the lung cleared and blastomycetes could not be detected in sections of the lung

7 The various forms of treatment were unsuccessful

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New Camera Records Stages of Ear Disease—The interior of the human ear can now be photographed with a new camera developed by Dr Richard Millar, director of the photography division of the Methodist Hospital of Indianapolis. The ear camera is hailed by the medical world as a distinct step forward in the treatment of ear diseases. For the first time in medical history a pictorial record of different stages of ear diseases can now be kept.

The camera takes pictures 120 times as large as the inner ear. With the use of a special concave mirror, a powerful beam of cold light is focused ingeniously into the patient's ear. The exposure is made through a hole in the center of the reflecting mirror

which is turned to deflect the light from the lens of the camera. Heat is extracted from the light beam by passing it through a flat glass flask filled with ice water before it reaches the ear. A clever ground glass arrangement fitted into the side of the camera enables the surgeon taking photographs of the inside of an ear to see the image which is passing through the camera lens even when he is operating the shutter. Thus he can see exactly the image that falls on the plate or film.

Dr Millar is now at work on a camera which will take the picture of the back of the eye. He predicted that soon a camera will be developed to photograph the inside of the human head from the inside.—*Science Service*

where in connection with another case The histologic finding in the present case substantiates the observations laid down at that time

We tried to get some idea of the source of infection in this case The house in which the patient was living appeared to be very unhygienic, but the walls and the floor of the dirty grocery store and the cellar beneath were unsuccessfully searched for molds or fungi The other members of the family did not show signs of blastomycosis

BONE LESIONS

One of us (L R L) collaborated in preparing this case report with a view to laying down criteria which would permit the recognition of cases of blastomycosis from the roentgen-ray appearance of the bone lesions

Potter (6) describes the lesions as occurring most frequently in the long bones near the epiphyses There is rarefaction and a rather marked periosteal proliferation The bone surrounding the focus shows little change He summarizes by saying "Such a marked localizing destruction occurring within spongy bone of a diaphysis, together with a mature and homogeneous periosteal proliferation with or without cloaca, is so constantly present in the ordinary lesions of blastomycosis that when seen in further skiographs where the etiology has not been determined, a careful search for blastomycetes should be made"

Carter (1), in a very excellent review of coccidioidal granuloma, summarizes by saying "The resemblance to blastomycosis is greater than to tuberculosis and distinction would seem difficult if not impossible" He lists lesions of the bony prominences such as the poles of the patella, acromion or coracoid processes or angles of the scapula olecranon or styloid processes of the ulna styloid processes of the radius, condyles of the humerus, extremities of the clavicles, of the malleoli, tuberosity of the tibia, solitary

marginal lesions of the ribs, localized destructive lesions of the outer table of the skull, and destructive lesions of the various parts of the vertebrae as being distinctive of coccidioidal granuloma.

Considering the data of the literature from the radiologist's point of view, the bone lesions of this case resemble coccidioidal granuloma more than they do blastomycosis Nevertheless, the bacteriologic examination revealed typical blastomycetes, therefore, we are led to the same conclusion as Carter (1), cited previously

It seems possible, however, to differentiate with the X-ray purulent and tuberculous osteomyelitis and metastatic bone tumors from bone lesions caused by *Coccidioides immitis* and blastomycetes, thus establishing a correct early diagnosis of the latter diseases

TREATMENT

Concerning the treatment of generalized blastomycosis, our case will only increase the number of those which ended fatally, as is the usual outcome of the systemic disease The mortality is nearly 100 per cent In our case, oral and intravenous potassium iodide and neo-arsphenamine evidently had no effect It seems to us that the constantly good appetite of the patient and the evacuation of abscesses with the applied local treatment were more important We have to admit, though, that while treatment served to prolong life, it did not prevent extreme emaciation and the development of other foci Death occurred in extreme exhaustion

SUMMARY

- 1 A case of systemic blastomycosis is reported in a white male who had spent his entire life in New York State

- 2 The disease was characterized by

millampere meter we have an instrument reading directly the millampere time product consistently and accurately for times as short as one-half cycle and up to one second. This, when used in conjunction with an ac-

value rapidly decreased as the time lengthened and eventually reached the mean value of 200 ma for sustained exposure. It was noted that the milliamperage decreased as the kilovoltage was decreased below the satura-

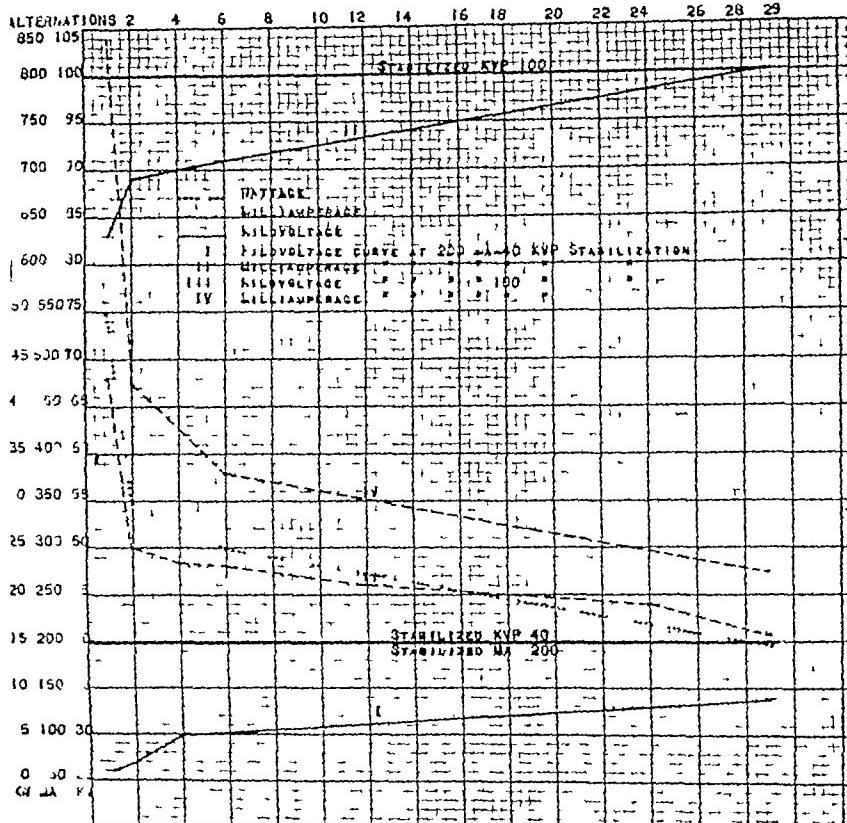


Chart I

curate timer, will allow for the exact computation of current flowing and is the basis for the interesting determinations we have made.

Using the materials described, observations have shown that variations of more than 400 per cent are common in milliamperage and that detection of this variation is impossible except with the ballistic meter. With the Coolidge filament set at the proper point to allow a 200 ma stabilized current to flow through the tube, our data prove that 840 ma were actually flowing when this tube was energized for one alternation. This

tion point of the tube, which in our case was 74 K V P at 200 milliamperes.

Conversely, we find, when energizing the tube under the above conditions, a minimal kilovoltage reading occurs which follows an inverse curve to that observed in the case of the current. A stabilized value of 40 K V P is reduced to 27 K V P for an exposure of one-half cycle. As the time is increased, this value gradually approximates the predetermined sustained kilovoltage.

The difficulties produced by these phenomena are great, as there is neither a stabilized kilovoltage value nor a consistent

FURTHER OBSERVATIONS ON HIGH MILLIAMPERAGE TECHNIC¹

By JOHN D LAWSON, M.D., and EARL H GRAY, M.D.

From the Department of Radiology, Woodland Clinic, WOODLAND, CALIFORNIA

CONSISTENT duplication of radiographic results may be accomplished only when the factors entering into the exposure are subjected to absolute and accurate control and precision. The necessity for this precision is most pronounced when high milliamperage exposures for a short time are utilized. In a previous article on this subject,² one of us (J. D. L.) endeavored to outline the advantages of a technic for chest study embodying high energies for a short-time period.

In an attempt to give this type of radiography the status which we believe it should have, considerable experimental study is being devoted to this subject in the Woodland Clinic Laboratory, the source of these articles. Several important phases will be considered in subsequent communications.

Unless it is possible to give definite factors which will, on all types of equipment, produce the same results, we have not assisted radiology in the solution of a problem, nor have we contributed to the popularization of that technic which seems in our mind to have great advantages.

In this presentation we desire to focus attention particularly on the difficulties, which are brought about by mechanical inaccuracies, surrounding work in the high milliamperage field. We refer especially to the measurement of time, milliamperage, and kilovoltage.

Control of the time factor to a minute fraction of a second may now be accomplished by means of the synchronous timer

which makes and breaks at zero potential, and times varying from 1/120 to $\frac{1}{4}$ second may be accurately and consistently obtained. Previous to the use of this timer, we worked with three ordinary motor-driven timers, none of which could be regulated in any way to approximate consistent duplication. In none of these was an exposure of less than 1/20 second obtainable.

All timers have been checked through the use of the spinning top with a small punch hole in the periphery, giving a recorded proof of the number of electric cycles during which the tube was energized. In this paper we will speak of time in terms of half-cycles, or alternations.

All observations have been made on a four-valve rectified unit with a primary current of 240 volts drawn from a 30 K.W. transformer through 120 feet of 000 copper wire. The same tube, a broad focus universal, has been used throughout. Milliamperages were recorded on two ordinary and one ballistic millampere meters in series.

Kilovoltages were recorded on a 12.5 cm. sphere gap which had previously been calibrated by means of a spectroscope and corrected for temperature, barometric pressure, and humidity. A ballast tube was used in shunt to protect the valves when using the sphere gap.

Until recently, the reading of milliamperage has been confined to the use of a standard millampere meter which necessitates that energy be applied for at least one second before stabilization of current is reached. This length of time must elapse before the forces of inertia and momentum are overcome and an accurate reading may be obtained. However, in the ballistic mil-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles Dec. 1 to 5 1930

²Lawson, John D. High Milliamperage Technic. RADIOL., November 1930, XV 575 578

ly applied, have assisted greatly. We may now measure kilovoltage and milliamperage accurately even for a period of 1/120th of a second, which time may also be accurately obtained. It is a rather expensive procedure to calibrate machines, but, of course, more expensive to develop the various defects which have been carried through the years of ra-

diological development. However, once these points are eliminated, which they will be one by one, we feel that it will become possible for the standard technical set-up to be used universally. A continuation of the work on this subject will probably produce many other observations which have bearing on the subject presented herewith.

CANCER CLINICS DECLARED OF GREAT COMMUNITY VALUE

If a cancer clinic can be made popular in a community it will tend to keep patients from going to cultists and charlatans, is the opinion of Edward J. Klopp, M.D., of Philadelphia, who discussed the advantages and organization of such clinics at the meeting of the American College of Surgeons.

"The patient receives careful consideration, good advice and the best treatment the hospital of the community affords," Dr. Klopp said.

The staff of such a clinic in the general hospital of a large city should include specialists in surgery, in pathology for examination of tissues to determine whether or not they are cancerous, in X-ray work, in radium and electrical treatments, in internal medicine, syne-

cology, skin diseases, urology, ear, nose, and throat diseases, a bronchoscopist, a chemist, a social service worker, and stenographic and technical assistants, according to Dr. Klopp's outline.

If there is opposition to the formation of a cancer clinic, it can be established purely for consultation and follow-up work, Channing C. Simmons, M.D., of Boston, pointed out in discussing the tumor clinic of the Massachusetts General Hospital.

"A hospital is established primarily for the treatment of the sick. It is necessary to prove to the trustees and staff by the work of its members that the treatment advocated by the cancer clinic gives a larger percentage of cures in the early cases and a longer span of life in the hopeless cases," Dr. Simmons said.—*Science Service*

current flowing for the first 30 alternations True, the calibration of any machine may be accomplished and results be duplicated, but to expect the results obtained on one unit to be applicable to another will certainly meet with disappointment

Calibration of a mechanically rectified unit, while not complete, seems to indicate that it also shows a marked variation in kilovoltage and milliamperage but the curves will vary considerably from those obtained on the valve equipment

It is the intent of the writers to attempt to clarify, in further articles on the subject, the many questions which are brought to the surface in this paper The exact bearing and relation of surges, transformers, capacity of primary line, individual rectifying variations, type of rectified wave, and many other factors must be considered before final judgment is formed

It is in order, however, in view of the information at hand, to state that, without accurate timing and measurement of milliamperage through use of the ballistic milliamperc meter and careful determination of the kilovoltage factor, no satisfactory work may be accomplished in the high current field All other factors remaining the same, careful and accurate calibration of equipment will permit of reduplication of results and accomplish the desired effects

DISCUSSION

DR. JOHN R. CARTY (New York City) I cannot add much to the discussion of Dr Hunsberger's paper (see p 320) We adhere to a standard technic, deviating only when special occasion arises, which in our experience has been rather infrequent

As regards Dr Lawson's paper, I wish to commend him for his painstaking work in developing high powered radiography As a result of the increasing interest in speed radiography many undoubtedly will install suitable apparatus Unless, however, there is a thor-

ough comprehension and consideration of all the known factors there will be many costly disappointments and fast radiography will suffer condemnation For instance, if the primary source of current is not adequate the results will be extremely poor Installations of high powered radiographic apparatus have been made, only to find that the source of current is unsatisfactory, necessitating expensive alterations I feel that there is a great future in this type of work as motion during exposure is one of the greatest enemies we have to contend with in producing satisfactory radiographs

DR. LAWSON (closing) When we had completed our study, Dr Gray remarked, "You know, it seems a rather unsatisfactory proposition to present work which contains a great deal of destructive criticism without having anything of a constructive nature attached to it" It was Dr Gray's idea that this work was almost entirely destructive, but, after reviewing material which has been presented, I believe the morals which may be drawn from it are such that the facts presented must be considered as constructive in nature inasmuch as we have called to the attention of radiologists that we have in the past been working with unknown factors Our timers have been inaccurate, the exact amount of current which is flowing during a short interval could not be estimated, and kilovoltage determinations have not been made as frequently as possible One laboratory can reduplicate the results of another laboratory, providing the two laboratories speak the same language or have their equipment calibrated accurately so that the units are interchangeable, and when it is possible to have one laboratory indicate a type of exposure to be instituted in a similar institution two thousand miles away, and be assured of a satisfactory result, we feel that considerable has been accomplished A primary hindrance in radiographic work has been inadequacy of equipment, or, one might say, the lack of satisfactory measuring apparatus There have been certain mechanical and electrical developments within the past year, which, when commercial-

suit the requirements of this case, a minor fracture would have been inconclusively shown, and an important fracture would have been completely missed.

In cases in which full extension of the elbow is not possible, the same principle requires that two anteroposterior views of the elbow be made. One view should be taken with the condyles of the humerus as close as possible to the plate, and one view with the head of the radius as close as possible to the plate. According to my experience, fractures of the head of the radius are among those most likely to be missed, hence the greater need of the two anteroposterior views in the circumstances mentioned.

In skull examinations, by adapting the technic, a fracture may be demonstrated the existence of which would otherwise not be suspected. This was first shown to me by a hospital case in which routine stereoscopic views of the skull in four directions were pronounced negative by a competent roentgenologist. The interne on the case was astonished at the negative findings. In viewing the films, he pointed to a very faint line in the region where, clinically, he had every reason to suspect fracture. The line certainly bore no resemblance to the ordinary fracture line, and he who diagnosed it as such would certainly have been rash. At my suggestion, we had the patient return to the X-ray laboratory, where we placed the suspected area directly upon the plate and took an oblique view. The result was a fracture line that stood out so clearly no one could question it. Even the technician could see it plainly on the wet film. The oblique view of the skull showed a long vertical fracture of the posterior part of the parietal bone, which was not shown in the stereoscopic lateral projection.

In addition to closeness of the fracture to the plate, a second factor of great importance is the direction of the ray with relation to the line of fracture. If the central ray is parallel to the line of fracture, or nearly so,

the fracture is likely to be registered on the plate, if not, it may be missed. As fractures may occur in any plane, the greater the number of directions from which the ray strikes the suspected part, the greater the number of fractures that will be shown. In practice, this means that the part should be placed in as many different positions as possible, or practicable, for exposures. In a series of 1,035 fractures encountered in the X-ray Department of the United States Marine Hospital, San Francisco, 36, or 3.5 per cent, were recorded as being shown in only a single view. In all these cases the examination included three or more views. If only anteroposterior and lateral views had been made, these fractures would have been missed.

The routine examination of the wrist, in the majority of laboratories, includes three views, the anteroposterior, the lateral, and the oblique. If any of these is omitted, numerous fractures will be missed. In the ankle, the oblique view is especially well adapted to show fractures through the posterior portion of the articular end of the tibia, the so-called Cotton fractures, which frequently accompany fractures of the malleoli, or of the distal ends of the tibia and fibula. Cotton fractures are usually vertical, involve the joint, and are accompanied by no displacement. Many of them are missed in the lateral view, but, since the accompanying fractures are usually shown, perhaps no great harm is done. In a certain percentage of cases, however, a Cotton fracture, unaccompanied by any other fracture, will occur in such a plane that it can be shown only by the oblique view.

As the bones of the shoulder girdle, with their processes, extend in so many different planes it could hardly be expected that routine stereoscopic views in only one direction would show every fracture. Nevertheless, it required the following case to teach me this fact.

The surgeon in charge of the out-patient

ADAPTATION OF TECHNICS TO INDIVIDUAL CASES

SOME SPECIAL VIEWS THAT HAVE PROVED VALUABLE¹

By HARVEY S HUNSBERGER, M.D., SAN FRANCISCO

THE difficulty of accurate fracture diagnosis was first forcibly impressed on me by a case of fracture of the os calcis. Clinically the ankle was suspected, but the usual ankle films were negative. Next, request was made for films of the os calcis. Satisfactory views, both lateral and vertical, were negative. Films of the metatarsals were then requested, but the metatarsals showed no fracture. However, the oblique view of the metatarsals showed very clearly a transverse fracture $\frac{1}{2}$ inch deep in the anterior articular surface of the os calcis. In this case, only *one film out of seven showed the fracture*, and that film was made for the study of an entirely different part.

In general, more fractures will be demonstrated, and doubtful fractures will be made clear, if the part suspected clinically or after an examination of preliminary films is brought as close as possible to the plate. In many instances, this may necessitate a departure from routine or standard positions. For instance, in making special views of the carpal trapezium (os multangulum majus) dental films were used. The wrist was so rotated that the lateral border of the trapezium, where the fracture was suspected, was brought close to the small film. The dental negative demonstrated the fracture clearly, but the usual views of the wrist, though of good technical quality, did not show the lesion clearly enough to permit a positive diagnosis.

The principle above stated has its application to the foot. In the routine examination of the foot, three views are usually included, the anteroposterior or vertical, the oblique, and the lateral. In all of these

views, however, the posterior ends of the first three metatarsals are considerably removed from the plate, owing to the upward convexity of the longitudinal arch of the foot. This is also true of several of the tarsal bones, notably the scaphoid and the three cuneiform bones. When a lesion of any of these bones, or of their joints, is suspected, it is important to take postero-anterior views. The patient is placed prone, with the foot in extreme dorsiflexion on an angle board, the ankle being higher than the toes. The tube is tilted about 15 degrees from the perpendicular toward the head, being centered over the bases of the metatarsals. The following case illustrates the importance of this view.

W K came to the laboratory Aug 29 1930, for examination of the left foot and ankle. The following report, in part, was rendered: "No important fracture of the bones of the left foot or ankle can be made out. There is a small, irregular fragment of bone lateral to the base of the first metatarsal that may have been separated by a crushing fracture. This is not certain. If the matter is of sufficient clinical importance, further light might be shed by special views, but it is possible that such views might not furnish a definite answer to the question."

On Sept. 15, 1930, the patient returned for additional studies, and the following report was made: "Special views of the left foot designed to bring out detail at the bases of the first to third metatarsals, with similar views of the normal foot for comparison show a fracture of the base of the third metatarsal in the horizontal plane, separating a fragment 1.5 cm long. The fracture involves the joint."

If the technic had not been adapted to

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles Dec. 1-5, 1930.

DR. D M CHRIST (Glendale, Calif.) This paper brings up a point which I believe should be mentioned here. We are often unable to collect payment for the number of films necessary to arrive at the proper diagnosis, and the insurance companies frequently object to multiple exposures for the detection of injuries in cases in which fractures are suspected.

I remember being at the San Diego meeting in the Radiologic Section a year ago last summer at which one of the members of the Industrial Commission told the Radiologic Section that we were supposed to have a right to demand a sufficient number of exposures to arrive at an intelligent diagnosis. He further stated that the Industrial Commission would no doubt bear us out in a reasonable number of exposures.

On two or three occasions I have received letters from the attorneys for the industrial insurance companies, stating that they had reduced the bills because of unnecessary exposures, and were inclosing checks for the amounts which in their judgment were correct.

In one such instance, my very resourceful secretary defeated this encroachment by writing the attorney that the charges and the exposures were those which were regularly routine as recommended by the Industrial Commission, and, since our charges were correct, we would hold the check until such time as he saw fit to send the balance due. We later received another letter indicating failure of the attorney to understand. We wrote in detail, explaining the necessity of the total work done, and mentioning the rulings of the Industrial Commission in these cases. We further offered to interview personally the attorney to explain the necessity and nature of the

work. If the attorney was still unconvinced regarding the matter, we advised him that we would arrange for a hearing by the Industrial Commission. The correspondence convinced this attorney without his even coming to see me and without any further trouble whatever.

Now, whether he was convinced by my explanation or whether he thought he would see the light when he got before the Industrial Commission I do not know, but it is necessary for the radiologist to emphasize the importance of his position. Even if one has to go to the expense of bringing some of these attorneys to a hearing before the Industrial Commission, I feel it should be done. All the money that the attorneys for an insurance company can divert from the roentgenologists' fees may accumulate to an amount sufficient to impress the company directors with their attorney's worth, but it appeals to me as being very unfair to us. I merely relate this as a system which I have developed during a good many years in working for industrial insurance companies, and I find that, after they are brought to a full understanding, the difficulty is soon eradicated. If we, as radiologists, will stand upon our rights and follow this matter through to the proper settling of affairs, it will not pay us personally from the standpoint of dollars and cents, but many individual efforts toward bringing the light to these people will benefit the whole radiologic association.

DR. HUNSMERGER (closing) Perhaps I shall take Dr. Stone's suggestion and present this matter to the surgeons at some meeting. Of course, the entire point of the paper is that the diagnosis of fracture is far from a simple matter.

department of a hospital requested X-rays of a patient's shoulder, suspecting fracture of the clavicle. The usual stereoscopic anteroposterior views were negative. The surgeon could not understand this, as he felt both crepitation and movement. Review of the films, which were technically satisfactory, disclosed no fracture to the surgeon or the roentgenologist. The clavicle appeared perfectly normal. The patient, however, was returned to the laboratory, and a postero-anterior projection was made. This view showed an unmistakable fracture of the clavicle, some separation of the fragments.

Fractures of the scapula undoubtedly fail to show in the anteroposterior view more frequently than any other fractures about the shoulder. If the arm is elevated in a special anteroposterior view, fractures of the axillary border of the scapula will be found that would otherwise be missed. Even this view may fail to show a fracture of the axillary border, which may be seen only in the anterior projection. Since I have discovered that a fracture of the spine of the scapula also may fail to manifest itself except in the anterior projection, an anterior projection of the shoulder is part of the routine examination in the laboratories of which I have charge.

Fractures of the acromion process of the scapula near its tip are common. Since the anterior end of this process lies almost in the coronal plane, such fractures are not easily seen. Special anterior projections, made with the shoulder on an angle board tilted toward the head and toward the feet, respectively, and with the tube tilted about 10 degrees toward the head or toward the feet to correspond, may aid in demonstrating these fractures.

From stereoscopic views, one gains a more accurate perception of relations. When the relations are complicated, as in the numerous bones of the wrist and foot, and in the astragalocalcaneal joint with its

irregularities, stereoscopic views, with similar views of the normal part in exactly the same position, for comparison, will often clear up a difficult fracture. Such views are also valuable in detecting minor degrees of dislocation, especially of the carpal bones, which are otherwise virtually beyond detection.

SUMMARY

Routine radiograms sometimes fail to reveal fractures that are present. Special views sometimes do reveal them. In making special views, the part should be brought as close to the film as possible and projections made from as many different angles as possible.

DISCUSSION

DR ROBERT S STONE (San Francisco) I think that a paper such as Dr Hunsberger's should be presented before an audience not exclusively of radiologists. Our excuse for existing as roentgenologists on fracture work lies in the very point Dr Hunsberger has brought out. If we are going to be merely technicians, taking only anteroposterior and lateral views of the cases that are sent in to us and reading only those views, then the average surgeon dealing with fracture work can handle the case just as well, or better, than we can. Our reason for existence in fracture cases is that we understand the principles of projection of these different fracture lines and on a great many of the cases that come to us we must use other than routine views to arrive at a diagnosis. Our medical training and special X-ray training have to be adapted to this work, and it is our sole excuse for being specialists in this field. I should certainly like to see a paper of the type of Dr Hunsberger's put before the surgical section of the American Medical Association or some other general meetings so that others may realize the detection of even fractures is not so simple as a great many general men consider it.

crease in the density of the bone, and the vault of the skull presents a peculiar serrated appearance An X-ray examination should be made of all patients with chronic bone pains

In the advanced stages the appearance and gait of the patient are highly characteristic The short squat figure with bent shoulders, curved back, sunken chest, long arms, and great head hanging forward, waddles along with bowed legs, out-turned toes and the aid of a stick, the living justification for the term "osteitis deformans"

Although this disease is slowly progressive, it may not shorten life, and is compatible with unimpaired mental activity

The etiology of Paget's disease of the bone is unknown Paget, himself, regarded it as a chronic inflammatory condition French workers consider that it is a late manifestation of syphilis, congenital or acquired In this age it is only natural that the opinion should be expressed that the condition is due to disorder of the ductless glands The undoubted relation of the pituitary gland to acromegaly lends considerable support to this view Hawk has demonstrated metabolic changes of importance There is a marked retention of calcium, magnesium, and phosphorus, and a large elimination of sulphur As calcification proceeds, the sulphur is replaced by calcium, magnesium, and phosphorus, being then excreted in the urine

Since it is a disease of advancing life, there is no question of disturbance of ossification along the epiphyseal line Instead, the condition is one concerned with extensive resorption of the normal bone by osteoclasts and the excessive new formation by the osteoblasts of irregular bony lamellæ which accompany the fibrous marrow The marrow actually loses its blood-forming elements, becoming converted into a vascular fibrous tissue which produces much soft, bone-like tissue

The architecture of the bone is disorganized, and the cortex loses its dense character and sharp outline The marrow cavity is encroached upon until it is filled completely, a thick subperiosteal layer being formed In this new tissue the lamellæ run in every direction and occasionally there are cysts or spaces filled with fluid, or tumor-like growths may appear

In the early stages of the disease the bones are so soft that they can be cut with a knife, but later they may become extremely hard As already indicated, the essence of the disease is bone absorption, associated with, or followed by, increased bone formation The bone absorption leads to great enlargement of the haversian canals

In Paget's original specimens there were innumerable apertures for vessels, and the whole skull was finely porous Cole, in a recent paper on the pathology of Paget's disease, lays great stress on the vascular changes in a case which he examined The vessels in the bones showed varicosity, thrombosis, congestion, hemorrhage, and leakage with edema Cole says, "My impression is that we have a primary blood vessel pathology such as one sees in syphilis, hereditary or acquired, with accompanying bone changes" The vascular lesions he considers infectious in origin

Absorption is followed by the formation of new osteoid tissue, soft and pliable at first, but later becoming rigid through the deposition of lime salts The new bone is chiefly deposited from the periosteum, but a slight deposit may take place from the medulla. The medullary cavity becomes obliterated, although not by the formation of any dense bone, and is filled with a vascular fibrous tissue which may produce soft osteoid tissue The diploë of the skull disappears and the distinction between the outer and inner tables is lost

Paget's disease is a strong predisposing cause towards the development of sarcoma

CLINICAL AND THERAPEUTIC CONSIDERATION OF OSTEITIS DEFORMANS¹

By WEBSTER W BELDEN, M.D.,² and ALICE R. BERNHEIM, M.D.,
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THIS rare and interesting condition, the exact nature of which is still unknown, was first described by Sir James Paget in 1876. It begins usually after the age of 40. The youngest case that the authors have been able to find reported is that of a patient in Dr LeWald's series who was 31 years of age when the disease was first noted.

The essential feature of the disease is an associated softening and overgrowth of bone, with persistent bone pains forming the chief subjective symptom in the earlier stages. As to clinical features, the bones principally affected are the skull, the vertebrae, and the bones of the leg, but almost any bone may be involved. As a rule the disease manifests itself in a number of bones, but in rare cases it may be confined to one, the diagnosis being then a matter of great difficulty. The bones of the lower limbs are usually the first to be affected, but in a number of cases the disease has been known to commence in the skull. The softened bones of the leg, having to bear the weight of the body, become bent, the femur bends outward, the tibia forward. The patient, therefore, becomes bow-legged. In addition to the bowing there may be a marked twisting, so that, as DaCosta remarks, "The femur comes to look as though it had been grasped by the hands of a giant, bent into a bow, then twisted."

Other factors, in addition to that of body weight, must be responsible for the deformity, for the bones of the arm also become bent, although to a lesser degree. In this

case the curve is backward. Associated with the bending, or even before it occurs, there is a characteristic thickening of the bone. The bone pains, which are so constant a feature of the disease, are felt particularly in the legs, seldom in the arms or head. They may be continuous or periodic and may appear many months before any gross lesion can be detected.

Enlargement of the skull is almost always present at some stage of the disease. It may be the first sign to appear, and may attract attention through the patient noticing that he has to buy hats of ever-increasing size. The deformity in typical cases is so characteristic that it can be recognized at a glance. The head becomes a triangle, with the base above, the face usually escaping almost completely. The enlargement is due to an enormous deposit of bone on the outside of the cranium, there is no endocranial thickening. To those cases in which the facial bones and the bones of the skull are thickened whilst the other bones escape, the name "leontiasis ossea" is given.

The vertebral column is almost always involved, and marked kyphosis develops in the dorsal and lower cervical regions. As a result of the kyphosis, the patient shrinks in height, a condition which is aggravated by the bowing of the legs. There are cases in which a man has lost as much as a foot in stature.

The clavicles may be affected, and, in exceptional cases, the bones of the hands and feet. The pelvis may be broadened, the ribs thickened, and the chest deformed.

The X-ray examinations show characteristic changes long before any deformity appears. There is great thickening and in-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles, California Dec. 1-5, 1930.

²Doctor Belden died shortly after presenting this paper before the Radiological Society. John Remer, M.D., his friend and associate, read the manuscript with the purpose of carrying out any changes which Dr. Belden might have made.

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Paget's disease is a strong predisposing cause towards the development of sarcoma

of bone, which has occurred in nearly 10 per cent of the recorded cases

We are becoming more convinced that this group of bone diseases has some relation to metabolic unbalance governed by the ductless glands, the gland which is probably responsible being the parathyroid. This seems rather definitely established in osteomalacia but is still a moot point in regard to osteitis deformans and generalized osteitis fibrosa cystica.

It seems appropriate to state here that the localized form of osteitis fibrosa cystica does not belong in the same class as the generalized type described by von Recklinghausen. The consensus of opinion to-day seems to indicate that the localized form is a chronic non-suppurative osteomyelitis, with which theory we are heartily in accord, with the exception that we do not feel that it is to be classed with the non-suppurative sclerosing type of osteomyelitis as described by Garré. To substantiate this claim we rely on the appearance of the lesions in the radiographs. In the former, the X-ray appearance is very much like the generalized form of osteitis fibrosa cystica and osteitis deformans, but it does not show the dense ivory-like appearance so characteristic of the sclerosing osteomyelitis of Garré.

A differential diagnosis among localized osteitis fibrosa cystica, the generalized form, and Paget's disease is often of the utmost difficulty. We are still of the opinion that generalized osteitis fibrosa cystica and osteitis deformans are different manifestations of the same disease at different age-periods of life, but, as stated above, we feel that the localized form of osteitis deformans is due to a previous infection which causes a sterile non-suppurative osteomyelitis or osteitis

When one enters upon the discussion of the therapy of osteitis deformans, or Paget's disease, and reviews the literature on this subject, it is found that practically all the drugs included in both the American and

British pharmacopeia have been used from time to time. For the past few years at the New York Hospital we have been treating these cases by the administration of calcium lactate, Vitamin D (viosterol), and tomato juice.

The following is the description of the theory and detail of the therapy used.

One of us (A. R. B.) has been particularly interested in the question of calcium metabolism and feels that the study of calcium, especially in its relation to the parathyroid glands, may be helpful in an attempt to gain an insight into the nature of these disorders. Observations have resulted in the development of a concept of the subject which may be stated as follows:

The parathyroid glands are mobilizers of calcium. One function of these glands is to control the stream of calcium from the trabeculae of the bones to the blood. The blood depends upon this supply for its normal concentration of calcium, and not upon the supply absorbed through the intestines, which is a very variable factor. Bauer and Aub have shown that on a low calcium intake of 300 mg over a three-day period, 790 mg are excreted, giving a negative balance of +90 mg of calcium. This may be considered the measure of endogenous calcium metabolism. It is interesting to note that no other inorganic substance behaves in this way.

Over-activity of the parathyroids, as in osteomalacia, increases the flow of calcium from the bones with a resulting osteoporosis, increased blood calcium, and increased excretion of calcium. When the glands are under-active, as in tetany, the output from the bones is lessened, and there is hypocalcemia and diminished excretion of calcium.

Another factor of importance in the calcium chemistry of the body is Vitamin D, of which there are two sources. The action of actinic rays on the sterol in the skin produces Vitamin D in the body, and it may be obtained by the ingestion of irradiated er-

C A L C I U M

| <u>INTAKE</u> | <u>ABSORPTION</u> | <u>IN BLOOD</u> | <u>IN BONE</u> | <u>IN OTHER BODY TISSUES</u> | <u>EXCRETION</u> |
|--|-----------------------------|---|---|-----------------------------------|------------------|
| 1 Food | Through the digestive tract | 1 Non-diffusible (bound to protein) | | | 1 Feces |
| 2 Water | | 2 Diffusible non-ionic (available) | 2 In the Trabeculae | | |
| 3 Calcium salts, as such | | {presumably the ionic portion of the diffusible Calcium is the usable or available form for the body} | {Already available} {Store of Calcium interchangable with that of the blood} | | |
| | | | | | |
| Vitamin D produced by the action of actinic rays on the sterol in skin, or furnished by ingestion of irradiated ergosterol | activates | Parathyroid Glands Which regulate mobilization of calcium in the body | I Vitamin D 2 Sterol of the skin poor in quantity or quality (so that the action of the actinic rays does not produce enough Vitamin D) | Possible Disorders in This System | |
| | | Blood | 1 Insufficient actinic rays 2 Sterol of the skin poor in quantity or quality (so that the action of the actinic rays does not produce enough Vitamin D) | | |
| | | I Non-diffusible Calcium | 3 Insufficient ingestion of Vitamin D 4 Excessively large doses of Vitamin D | | |
| | | 2 Diffusible | In experimental animals have produced areas of calcification in heart, muscles, kidneys, etc. | | |
| | | → Excretion | Excessive exposure to actinic rays does not produce such effects because of the protective mechanisms of tanning or browning of the skin (hair and fur and feathers in animals) | | |
| | | 2.Urine | | | |
| | | Other Tissues. | | | |
| | | | | | |
| Bone → cortex (stable) Trabeculae Bone (Store) Labile | | II Parathyroids | I Inactivity due to lack of Vitamin D 2 Inactivity due to disease 3 Overactivity due to disease | | |
| | | III Abnormal Absorption | | | |
| | | IV Abnormal Excretion | | | |
| | | V Disease of the Bone | | | |

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state of our knowledge, from what observations we are able to make, over-activity and dysfunction on the part of the parathyroid glands seem to be of etiologic significance in osteitis deformans.

In view of the similarity of all these cases of osteitis deformans we think it would be a waste of time and money to put illustrations of all the cases in this article and are, therefore, showing photographs of the entire skeleton of one of the patients who exhibited characteristic changes.

CASE REPORTS

Case 1 G W N, aged 47 years, was admitted to the hospital on Feb 7, 1927, the chief complaint being deformity of the bones and soft parts, with pain. The illness began three years before the present examination, when the patient noted a small lump on the anterior aspect of his left tibia. This was hard and bony in character and gradually increased in size, but was not painful except when struck. At a slightly later period the left knee began to swell and was painful, becoming stiff. Two years before admission to the hospital the patient, while throwing a baseball, sustained a fracture of the right humerus. Shortly after this had healed he fractured his left clavicle in alighting from a trolley car. About one and one-half years before examination the upper end of the left humerus began to swell and the shoulder to stiffen. The patient was able to abduct the arm only to a right-angle. In December, 1926, the shoulder became very painful and the patient complained of great heat in it, while the swelling increased rapidly.

During the entire course of his illness the patient had noted an increasing bowing of the legs and an increase in the size of his head, stating that it felt lumpy. There was gradual increase of pain in the back and legs. About three weeks previous to admission, a tumor mass appeared on the anterior

aspect of the right humerus, at the site of the previous fracture. At almost the same time the patient noted a cystic swelling in the right temporal region and about a week later two similar, though smaller, swellings appeared on the left forehead. He also complained of difficulty in walking and inability to adduct the left femur, due to a hard bony mass in the region of the lesser trochanter.

The past history comprised the usual childhood diseases but no other diseases or infections. The man had always been athletic in his habits. His family history was negative, except that the cause of his mother's death, at 86 years of age, was unknown. There was no history in the family of disease similar to that presented by the patient.

Physical Examination.—The patient was an under-nourished white male, who appeared chronically ill. Inspection showed a typical enlargement of the cranium and a face triangular in appearance. The anterior bending of the spine and the anterior bending and bowing of the femurs and left tibia gave the typical posture of Paget's disease. Over the right temporal bone was a cystic mass about 4 cm in diameter. In the left frontal region were two firm masses about 1.5 cm in diameter. The left clavicle was prominent and thickened, with a firm mass about the size of a walnut present near the outer end. The heart and lungs were negative. The liver showed some enlargement. The extremities showed bowing of the tibias, especially the left, bowing and thickening of both femurs, and a hard bony mass in the region of the lesser trochanter. The knee jerks were active. The left shoulder showed definite fusiform hard swelling of the upper third of the arm, which impaired the shoulder movement. The skin appeared fairly normal and its temperature was not elevated. Over the anterior aspect of the right humerus, about its middle third,

gosterol Vitamin D has two functions: it increases the absorption of calcium through the intestines, and it activates the parathyroid glands.

In the early stages of osteitis deformans we find osteoporosis, high blood calcium, and increased excretion of calcium. From these findings we may postulate an over-activity of the parathyroid glands. Later in the disease, when the formation of osteoid tissue and the erratic deposition of calcium in the bones occur, the blood calcium is found to be low and excretion is diminished. At first glance it would seem that under-activity had followed upon the preceding over-activity, but, by the token that calcium is deposited abnormally in large amounts in the bones, over-activity may be said to persist with *deranged* activity as an added factor.

In a study of eight cases, a low normal blood calcium (9 to 9.5 mg./100 cc.) was found in four of the cases in which the duration of the disease was known to be five years or more, whereas, in the other four cases, which were of shorter duration, the blood calcium was found to be above normal (11 to 12.3 mg./100 cc. of blood).

Since bone destruction was going on in all of these cases irrespective of their duration or other processes, we wanted to see in what way, if any, a high calcium intake would affect the calcium situation. Calcium lactate, or milk, and Vitamin D were given, also Vitamins A, B, and C. On this regime headache, backache, and stiffness in the legs were alleviated. There was marked improvement in the ability to walk and in three cases the patients abandoned their canes, without which they had been unable to get about. One woman had not been able to get up from a chair or to walk without assistance. She had had pains in her thighs and back. Improvement in her condition, which was marked after three weeks' treatment, has been continued for over two and one-half years. She is able to do her housework,

walks without a cane, and has been free of pain up to the present day. In this case, roentgenologically, there is no evidence of advance in the disease. In one other case, in spite of improvement in symptoms, there is marked progress in the bony changes, especially in the skull, which has increased in size during two years of observation and treatment.

Before coming to the New York Hospital, a number of patients had received calcium treatment without improvement. Administration is unavailing unless due regard is given to the conditions under which calcium is absorbed, which does not take place unless the digestive tract is empty.

Our regime is as follows:

Viosterol, drops X, three times a day,
Tomato juice, 6 ounces, three times a day,
Calcium lactate, gr XL, twice a day.

This is given one hour before breakfast and four hours after supper, or, if the second dose keeps the patient up too late at night, it may be given four hours after luncheon and one hour before supper. This regime is followed for two weeks, then three glasses of milk a day are substituted for the calcium lactate. A long continuance of the administration of calcium lactate often results in frequency of urination, hence alternating milk with the calcium lactate is found advisable. Every fourth week viosterol is discontinued for five days.

Treatment with parathyroid extract was next tried. The blood calcium was raised, as it was with the high calcium and vitamin regime, but there was no improvement in symptoms, in fact, the patients felt generally worse than with no treatment at all. Parathyroid extract increases the blood calcium by taking it from the trabeculae, which apparently, in this disease, are already giving it up excessively.

We are handicapped by the lack of instruments of precision for measuring the calcium situation *in vivo*, but in the present

The present condition showed nothing unusual except for the subjective symptoms. The family and past histories were irrelevant. The physical examination was entirely negative except for slightly hyperactive knee jerks and slight hyperactivity of some of the other tendon reflexes. The positive findings were that the history suggests a *petit mal* (Jacksonian epilepsy), slight sluggishness of the right pupil, slight deviation of the tongue to the right, large square head, slight impairment of hearing on the right side, and marked loss of weight.

X-ray Examination—The gastro-intestinal tract showed spasm of the pylorus, but was otherwise negative. Examination of the gall bladder was negative. The liver shadow seemed to be slightly enlarged. There was definite condensation of the body of the fourth lumbar vertebra, indicating an increased density of the bone due to calcium deposit, which suggested the sclerosing type of carcinoma metastasis. The bones of the skull showed marked thickening and mottling, with distinct rounded areas of increased density in both parietal areas, as well as rarefied areas. There was a slightly similar process in the right ischium and greater trochanter of the right femur. These findings were interpreted as osteitis deformans (Paget's disease).

The urinary examination was negative.

Blood Examination—Red cells 4,256,000, hemoglobin, 100 per cent, white cells, 6,400, polymorphonuclears, 74 per cent, lymphocytes, 24 per cent, Wassermann, negative.

During the patient's stay in the hospital he was afebrile, the pulse and respiration were normal.

Summary—This patient was evidently suffering from either epileptiform attacks or pachymeningitis, as there is nothing in his history that would suggest Paget's disease, although the X-ray findings are unquestionably those of Paget's. This probably means



Fig 1 The characteristic appearance of Paget's disease in the advanced stages—bent shoulders, curved back, sunken chest, long arms, bowed legs.

that the patient has a complication of these two diseases.

Case 3 M. W., aged 42 years, married, was admitted to the hospital on July 24, 1924, with the chief complaints of weakness and insomnia. The past history was negative except for attacks of quinsy.

Present Illness—For some three months the patient had been feeling weak and tired all the time although she had gained about five pounds. Insomnia, with headache in the posterior portion of the head, and pains in both legs had been constant features. In

was a hard swelling nearly the size of a plum. It was fixed, and seemed attached to the bone. In the lower portion of the left arm was a similar hard swelling, but smaller. The left knee showed a generalized swelling, most marked on the inner side. The ankles and feet seemed normal.

X-ray Examination.—Marked cortical thickening, irregularly striated, periosteal bone production and cystic formations were clearly seen in the left tibia, both femurs, the bones of the pelvis, and the spine. In addition, there was a marked increase in the size of the lesser trochanter of the left femur, giving the appearance of a large osteoid tumor. Examination of the skull showed marked deformity and thickening of the cranial bone, with irregular calcific deposits between the outer and inner tables. The right humerus showed the same changes as noted in the other long bones, and a tumor in the soft parts could be clearly seen. The left clavicle also showed degenerative changes and evidence of the old fracture. The upper end of the left humerus was almost completely destroyed, but showed some irregular calcific material in the region of the extensive tumor which invaded the soft parts.

X-ray diagnosis was typical Paget's disease, with degeneration and formation of an osteogenic sarcoma.

Laboratory Findings.—The blood showed red cells, 4,592,000, hemoglobin, 47 per cent, white cells, 9,800, polymorphonuclears, 76 per cent, lymphocytes, 21 per cent, Wassermann, negative.

Blood calcium at first, 10 mg per 100 cc., later, 12 mg per 100 cubic centimeters.

Urine analysis negative, no Bence-Jones bodies, urine calcium, 0.211 grams in 24-hour output.

During the patient's stay in the hospital his temperature varied between normal and 99° for the first seventeen days. On the eighteenth and nineteenth days it was 102°.

It then returned to the previous range of from normal to 99° until a few days before death, when it ranged from 100° to 103.5°. A consultation was held and it was decided that the numerous tumor masses were due to sarcomatous degeneration, for which high voltage therapy was advised. The patient was given eight therapeutic exposures to the left shoulder, anterior and posterior, to the lower dorsal and lumbar spine, to the left groin and femur, and the right humerus both anterior and posterior. John Reimer, M.D., gave these treatments, using the following factors 200,000 volts, 4 ma, 50 cm distance, with 0.5 mm copper and 1 mm aluminum filter. The total dose administered was 70 per cent depth dose to the different areas. Though the X-ray therapy resulted in no decrease in the size of the sarcomatous masses or X-ray evidence of changes, there was very marked relief from the patient's symptoms of pain and discomfort. He died on the forty-fifth day in the hospital. No autopsy was obtained.

Case 2.—Mr. McD., aged 59 years, was admitted to the hospital on March 31, 1926, complaining of headache, dizzy spells, and convulsive seizures. He gave a history of two injuries in childhood, with no sequelæ. For the fifteen years previous to examination he had had attacks similar to the ones for which he was admitted, but lately these had grown worse. Two injuries had occurred since the onset of his present illness. These attacks were always preceded by an aura, accompanied by spastic movements of the extremities and loss of consciousness. At times the attacks were limited to a short convolution, at others, they proceeded to loss of consciousness. They varied a good deal, but always started on the right side. Sometimes the man ground his teeth and bit his tongue. The patient had had a large amount of medication, with no relief, and had lost considerable weight. In 1925 he had had an attack of marked epigastric pain.

The present condition showed nothing unusual except for the subjective symptoms. The family and past histories were irrelevant. The physical examination was entirely negative except for slightly hyperactive knee jerks and slight hyperactivity of some of the other tendon reflexes. The positive findings were that the history suggests a *petit mal* (Jacksonian epilepsy), slight sluggishness of the right pupil, slight deviation of the tongue to the right, large square head, slight impairment of hearing on the right side, and marked loss of weight.

X-ray Examination—The gastro-intestinal tract showed spasm of the pylorus, but was otherwise negative. Examination of the gall bladder was negative. The liver shadow seemed to be slightly enlarged. There was definite condensation of the body of the fourth lumbar vertebra, indicating an increased density of the bone due to calcium deposit, which suggested the sclerosing type of carcinoma metastasis. The bones of the skull showed marked thickening and mottling, with distinct rounded areas of increased density in both parietal areas, as well as rarefied areas. There was a slightly similar process in the right ischium and greater trochanter of the right femur. These findings were interpreted as osteitis deformans (Paget's disease).

The urinary examination was negative.

Blood Examination—Red cells 4,256,000, hemoglobin, 100 per cent, white cells, 6,400, polymorphonuclears, 74 per cent, lymphocytes, 24 per cent, Wassermann, negative.

During the patient's stay in the hospital he was afebrile, the pulse and respiration were normal.

Summary—This patient was evidently suffering from either epileptiform attacks or pachymeningitis, as there is nothing in his history that would suggest Paget's disease, although the X-ray findings are unquestionably those of Paget's. This probably means



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Present Illness—For some three months the patient had been feeling weak and tired all the time although she had gained about five pounds. Insomnia, with headache in the posterior portion of the head, and pains in both legs had been constant features. In



Fig 2 There is typical enlargement of the cranium, the head is a triangle with the base above.

Fig 3 The softened bones of the leg become bent, the femur bends outward, the tibia forward

addition, there had been pains in the eyes, and difficulty in going upstairs, with dyspnea and marked palpitation on exertion. The family and personal histories were negative.

Physical Examination—The patient was an obese woman who appeared chronically ill. She exhibited edema under both lids, ptosis of the right lid, and irregular pupils. The mouth showed fair teeth and diseased tonsils. The lungs were negative, the heart rapid and of poor muscular tone. The blood pressure ranged between a systolic of 110 and 130. The abdomen was negative. The extremities showed slight edema of the ankles. There seemed to be swelling over the left greater trochanter, very slight limitation of flexion, marked limitation of internal rotation, and marked tenderness on pressure over trochanters. The patient's posture in the erect position was bad.

Laboratory Tests—Urine, negative

Blood count, essentially normal. Wassermann, negative.

Basal metabolism was —13. Blood calcium, normal.

The patient was under constant observation until Oct 20, 1927. On October 15 she reported very marked pain in the toes. On examination, they were seen to be shiny and of a bluish-red color, which strongly suggested, both from her description and the physical findings, a beginning thromboangiitis obliterans.

X-ray Examination—The radiograms showed a thickening of the cortex of the upper third of the left femur and some anterior bowing. There was a coarse striation in the region of the greater trochanter and neck, with an occasional small area of decreased density. The pubic bones, right ischium, and the wing of the right ilium showed the same changes. The lumbar spine was negative except for a hypertrophic

osteo-arthritis. The skull showed irregular areas of increased density between the inner and outer tables, which were more marked in the posterior half. There was considerable thickening, particularly in the occipital region. The other bones were negative. The diagnosis was osteitis deformans (Paget's disease).

Summary.—The attending physician's note was as follows: "The X-ray examination showed unmistakably the condition in the left femur, bones of the pelvis, and skull so characteristic of Paget's disease. The patient showed none of the clinical signs of Paget's disease and the age is rather young. It is interesting to note that this patient bears a close resemblance to the myxedema syndrome, in view of the theory that osteitis deformans may result from a calcium imbalance caused by disease of the parathyroid glands."

Case 4 C M., female, 53 years of age, was admitted to the hospital in December, 1923, complaining of swelling of the head, and deafness. For eight or nine years she had noted that her head was increasing in size on the right side. For three or four years she had had pain in her right ear, with increasing deafness. For the last few months before admission to the hospital she had noticed a headache in the frontal region when she coughed. She had been gradually losing weight for the five or six years preceding the examination.

The family history was entirely negative and no similar disease had ever been noted in the family. The past history was as above except that, in addition, the woman had been tiring easily for the previous few years and had had slight dyspnea and palpitation.

Physical Examination.—The patient presented a striking osteitis deformans appearance. She had a vacant dull appearance, was short of stature, and appeared stooped. The head was triangular in shape, with the apex downward. There was an unusually round-

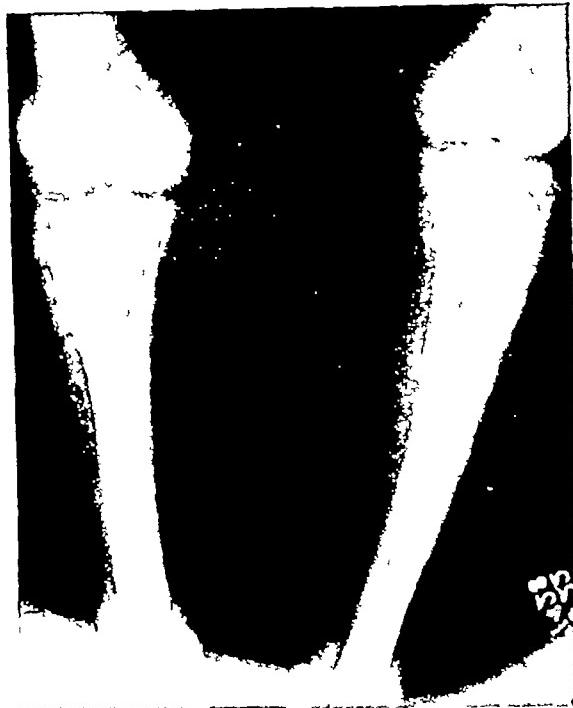


Fig. 4. The architecture of the bone is disorganized by osteitis deformans.

ed prominence on the right side in the temporal parietal region. Palpation of the head revealed thickening at the base of the skull, and increase in bone in both temperoparietal regions, with a definite rounded prominence on the right side. The circumference of the head was 66 centimeters.

The spine showed no definite kyphosis but a definite rounding of the shoulders. The left clavicle was unusually thickened and irregular. The ribs showed no abnormalities. The pelvis was settled and unusually funnel-shaped. There was slight thickening about both elbows in the upper extremities. The femurs did not appear bowed. There was general thickening about both knees and the anterior surface of the left tibia. The tibia was thickened in its upper third. The rest of the physical examination was negative.

The reflexes were all present. The blood count was normal and other laboratory tests showed no changes.

X-ray Examination.—Definite involvement of the skull, both femurs, and the

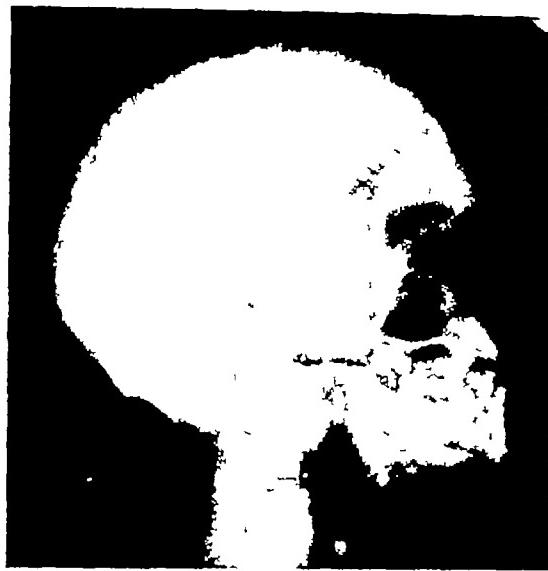


Fig 5. The vault of the skull presents a serrated appearance, and the diploë disappears, the distinction between the outer and inner tables being lost

bones of the pelvis was demonstrated by X-ray examination. There also seemed to be some changes in the ribs and the left clavicle, which showed typical bizarre arrangement in the bone trabeculae, thinning out of the bone, and bizarre calcific deposits so typical of osteitis deformans.

The patient, who was afebrile, left the hospital after staying seven days and no trace of her has since been possible.

Case 5 G C, male, 43 years of age, was admitted to the hospital in August, 1916, for a broken leg. About ten years previous to the present examination, the patient had begun to have pain in the left leg, extending the entire length of the shaft. The pain had been more or less constant up to the time of examination and it was getting gradually worse. Six years before admission to the hospital the patient fell and fractured the left femur just above the knee. The fracture healed, and there had been perfect function of the leg for two years. Then pains began in the right leg and the patient was forced to stop work on account of pain and weakness, and stiffness in both legs and knee

joints. He had been confined to bed almost constantly for two years before examination. In August, 1916, while turning in bed, the patient fractured the left femur about five or six inches above the site of the old fracture.

The history was difficult to obtain as the patient could not speak English. The past history was negative except as described above. The family history was negative.

The fracture was treated and reduced, a circular plaster spica being applied.

X-ray Examination—The patient exhibited a fractured left femur which extended through the shaft. The changes in the bone were quite typical of osteitis deformans.

Laboratory tests were negative.

The patient was discharged early in September, the leg healing. In April, 1917, report was that the patient had been in a city hospital for seven months with disease of the bone which was becoming progressively worse. There was no further follow-up.

The interesting thing in this case seems to be, if the patient's history can be depended upon, that his osteitis deformans started ten years previous to examination, which would make him 33 years of age. This is rather young for osteitis deformans but we feel the changes are so characteristic and the history so suggestive that he must come under this class.

Case 6 Mrs G H, aged 47 years, was admitted on June 30, 1925, to the Bloomingdale Hospital. The patient's family and personal histories were negative except for the mental condition for which she was admitted to the hospital.

The present illness dates from 1921, when a spur was noted on the patient's spine. She was examined by an orthopedic surgeon, who stated that the condition was either tuberculous or due to carcinoma. She was fitted with a spinal jacket, which she wore for a year, at which time she was pronounced well. Six months later it was



Fig. 6 (*upper left*) Enlargement of the skull is one of the first signs to appear in osteitis deformans
Fig. 7 (*upper right*) Fig. 8 (*lower left*) Fig. 9 (*lower right*) The cortex loses its dense character and sharp outline, the marrow cavity is encroached upon

noted that she was becoming round-shouldered, and she complained of pain but there was no local irritation. The patient had

several Wassermann tests made, but all were negative. She attempted to commit suicide by cutting her wrists and exhibited symp-

toms of manic depressive. She lost about eight pounds in weight.

Physical Examination.—The patient was a poorly nourished woman, weight, about 100 pounds, face, somewhat puffy, color, poor, heart and lungs, negative except for a slight cardiac enlargement to the left, with soft systolic murmur, blood pressure, 106/50. There was slight edema of the ankles and the back showed angular deformity in the mid and lower thoracic vertebrae. The face was rather expressionless. The reflexes were slightly exaggerated. The rest of the examination was negative except for slight deformity and slight bending and thickening of the bones of the arms and thighs.

Blood Count.—Red blood cells, 4,500,000, hemoglobin, 60 per cent, white cells, 9,950, polymorphonuclears, 70 per cent. The blood chemistry showed nothing unusual and practically the normal amount of blood calcium.

X-ray Examination.—The spine showed marked changes in the region of the first, second, and third lumbar vertebrae, and obliteration of the normal outlines of the bodies, with displacement of the arterial surface, resulting in kyphotic deformity. These vertebrae showed very marked osteoporosis, giving a distinctly moth-eaten appearance. This condition extended to the sacrum, to both ilia, and the pubic bones. The upper ends of the femurs were likewise involved. The shafts of the femur and tibia were apparently normal. The right humerus showed some osteoporosis, which resulted in a moth-eaten appearance, extending along the middle of the shaft. The left humerus, on the contrary, showed marked defect, including throwing up into ridges of the shaft of the bone, with smaller areas of rarefaction in the lower ends of both radius and ulna. The shaft of the radius was fairly normal in appearance, but the shaft of the ulna had the same moth-eaten appearance.

as noted in other bones. The left radius and ulna were only slightly involved. The ribs also showed a considerable degree of rarefaction, giving them an irregular moth-eaten appearance.

X-ray examination of the chest showed the heart to be triangular in appearance, and enlarged (especially to the left) with a widening of the arch of the aorta. The apices were poorly illuminated. There was no irregularity of either diaphragm. There was considerable mottling at the roots of both lungs, with much increase in the peribronchial tissue. X-ray examination of the skull showed a slight degree of irregular rarefaction, giving a moth-eaten appearance such as is seen in osteitis. These findings were diagnosed as due to osteitis deformans.

The patient was discharged on Nov 16, 1926, much improved, and no further history was obtained.

Summary.—The age at which the onset of the disease occurred, namely 44 years, together with the characteristic X-ray findings, seems to place this case in the classification of osteitis deformans (Paget's disease). The mental symptoms probably have no bearing on the bone disease, though this patient, like the last two cases, showed some abnormal brain condition. Three cases, however, do not seem to be sufficient to warrant drawing any definite conclusions.

Case 7 Mr T., aged 70 years, is included in the series simply for the reason that his right femur and right ilium, ischium, and pubis exhibit the changes which are capable of interpretation as either osteitis deformans or osteitis fibrosa.

The history has no bearing whatever on the case. The patient had always been healthy and the only point which might be regarded as of any significance is that for a number of years he had had what he described as "twinges of rheumatism," and his knee joints, the articulations of the lumbar

vertebræ, and the left hip showed evidences of an hypertrophic osteo-arthritis.

On Dec. 5, 1926, at the age of 69 years, the patient was struck by an automobile, sustaining a fracture of the ninth rib on the right side and a fracture of the neck of the right femur. He was given the usual treatment for the fracture of the femur, remaining in bed for some twelve weeks. A radiograph, taken ten months later, still showed the marked osteoporotic, lacy appearance of the bone, with the mottling by areas of decreased density, suggesting beginning cystic formation. The skull showed no variations from the normal.

Summary—Are we to class this patient as a case of osteitis deformans, localized to the ilium, femur, right ischium, and pubis, or are the changes due to marked atrophy of disuse, accentuated by the patient's age? The evidence in favor of atrophy of disuse seems rather weak, as the radiograph made ten months after discharge from the hospital, while the patient was walking some three miles a day in the course of his occupation, showed the same changes to be present. Frankly, this is unquestionably a case which, in the light of our present knowledge, we cannot definitely classify. However, the atrophy of disuse, it seems, can be ruled out on the unilateral distribution of the changes, which would place the condition either in the group of osteitis deformans or in that of osteitis fibrosa cystica.

Case 8 Mrs. H., white, 57 years of age, consulted her physician for pain in her left leg, with increased anterior bowing of the lower leg. She had noticed this pain for several years but was not definitely sure for how long, the bowing had been present for three years. She paid very little attention to this until she struck her leg against a chair and heard something snap. She then found it difficult, in fact almost impossible, to walk on this leg. The radiographs made at that time showed definite disturbance in



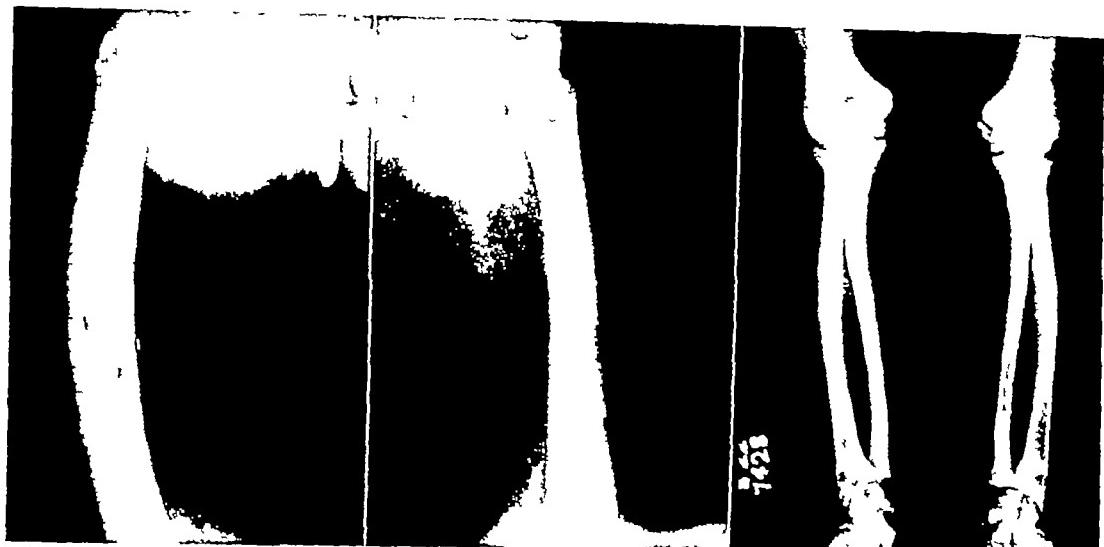
Fig. 10 Broadening of the pelvis is characteristically seen under X-ray examination.

the bone trabeculae, with cystic formation and bizarre calcific deposits with marked anterior bowing of the left tibia. There was also beginning involvement of the lower end of the left femur. The patient denied any knowledge of change in this bone previous to three years before the present examination. She was treated by the application of plaster, whereupon the fracture healed. She was then referred to an orthopedic surgeon, but, upon walking into his office, she turned her ankle and sustained two fractures of the tibia.

In view of the age of this patient and the characteristic changes in the tibia, even though the other bones were negative for any changes, one feels this is probably a case of osteitis deformans.

Case 9 Mrs. E. B., aged 50 years, entered the hospital May 2, 1927, the chief complaints being loss of weight, and weakness.

Present Illness—For eighteen months preceding examination, the patient had noted a feeling of weakness and of being generally below par. Her friends had noticed an occasional swaying as she walked. She, herself, had noticed a tendency to deviate to one side, and a desire to put out her hand to steady herself. Occasionally she felt light-headed, but had only transitory pains.



Figs 11 and 12 A well-defined thickening is associated with the softening of the bones, which, due to the weight, causes the femurs to bend outward

Fig. 13 The bones of the lower limbs are usually first affected, the tibia bending forward.

in the head and no other pains Fifteen months previous to her admission she had had a clinical examination in another institution, but at that time no lesions were found No X-ray examination was made then The patient had noticed an occasional numbness in her hands and weakness in her legs

The past history was negative except for tonsillitis in childhood and swelling of her joints two years before examination

The family history was negative except that the mother died at the age of 76 years from arteriosclerosis

Physical Examination—The patient was a well developed and well nourished adult female, who did not appear acutely or chronically ill She walked with an unsteady gait and showed a tendency to fall toward the right side The rest of the physical examination was negative except for superficial varicose veins in both legs and definite accentuated tendon reflexes in the biceps, triceps, and knee jerks

X-ray Examination—The skull showed typical, irregular, dense, calcific deposits, with the slight thickening of the outer table which is considered characteristic of Paget's

disease The second lumbar vertebra, the ilium, pubes, and ischium on both sides showed some deformity, being of irregular striated appearance and suggestive of cystic formation as the result of osteitis deformans The gastro-intestinal tract was essentially negative

Laboratory Examination—Red blood cells, 4,544,000, hemoglobin, 82 per cent, white blood cells, 7,200, polymorphonuclears, 66 per cent, lymphocytes, 33 per cent The Wassermann test was negative Blood sugar, 0.11 per cent, blood calcium estimation not made Urine no Bence-Jones bodies, negative for sugar and albumin

The patient was in the hospital for some ten days and showed no other points of interest The history and clinical findings were inconclusive, but, from the X-ray examination, the diagnosis was Paget's disease

Case 10 The patient, T S, aged 63 years, was an apartment house janitor who came to the Compensation Department because he had fallen and injured his knee while tending the furnace Physical examination showed thickening of the tibia and slight anterior bowing, but X-ray examina-

tion showed no evidence of fracture. The changes were interpreted from the X-ray findings as due to Paget's disease.

Unfortunately this patient did not return for X-ray examination of the skull and other bones and no past history was obtained, so that one includes this case as illustrative of Paget's disease solely on the X-ray diagnosis.

Case 11 Mr K, first observed in 1914, was at the time of examination 58 years of age.

At the initial X-ray examination a diagnosis was made of small gastric ulcer on the posterior wall, and possibly two small urinary calculi. In 1922, when the patient was again radiographed, the ulcer was not seen, and there was a delay in the third portion of the duodenum. A retrocecal chronic appendix was also diagnosed, and gastric retention was noted, interpreted as due to thickening of the pylorus from the old ulcer. In 1927, the patient was seen by Dr Williams, who elicited the history that in boyhood the patient had had an attack of appendicitis but no operation had been done.

The physical examination was negative. The patient suffered moderately from constipation and had occasional gaseous discomfort, which was relieved by powders. For the three years preceding examination he had had an irritating pain in the tongue, which showed a small induration. He smoked a good deal, was rather nervous, and had bad teeth, but they were being treated. He had no symptoms referable to the head, and had never had any bone or rheumatic pains. His history seemed to be entirely gastro-intestinal.

X-ray Examination.—Radiographic examination, made on Jan 20, 1927, showed a definite sclerosing process in the body of the second lumbar vertebra. A sclerosing process, though not so pronounced, with definite mottling and disturbance in the bone trabeculae, was noted in the left ilium, and,

to a lesser degree, in the right. The patient's skull showed the frontal and both parietal bones to be mottled by definite areas of increased density, which were irregular in outline. These areas were not characteristic of bony metastasis, and, when considered in conjunction with the findings in the second lumbar vertebra, the ilia, and the sacrum, one's impression would seem to be in favor of a diagnosis of early Paget's disease.

Summary.—This is another case in which no history, either family or personal, can be elicited to confirm the X-ray diagnosis of Paget's disease, though the changes noted on X-ray examination are so characteristic that there seems to be no doubt of the correctness of the diagnosis.

Case 12 Mr H is a man past middle life whose X-ray examination showed the typical changes of osteitis deformans. Unfortunately he is a private patient who was referred to the office, so that no history was obtained and none of the laboratory tests was done to our knowledge. We have since lost trace of the patient. We are reporting him in the series simply because of the characteristic bone changes.

Case 13 W R, white male, 37 years of age, was brought to the hospital on April 7, 1930, complaining of pain and stiffness and bowing of the left thigh which had begun 18 months previous to the examination. The family and past histories were negative except for the usual childhood diseases. The patient, who had played professional football for the preceding six years, and who was quite active in other sports, gave a history of many injuries to his head and neck. He had received a fracture of the jaw in 1927. He gave no history of headaches and was subject to very few colds. He had noticed slight deafness in the left ear for a year but no dizziness. Upon close questioning, the patient recalled that his symptoms probably started three years earlier, after an injury to his neck in a wrestling match.

The first symptom was a dull aching pain in the left thigh, with generalized tenderness. About one month later the patient noted a slight bowing of the thigh which progressed slowly for two years. About one year before the present examination, for eight or nine days, there was definite increase in deformity and severe pain, which had now ceased. He had received no treatment.

Physical Examination.—The patient was a man who appeared well—stocky, with a large head. There was slight lateral curvature of the left thigh and a slight waddling gait. The shoulders were slightly stooped and the head was held stiffly. The skull was negative, except for being large. The neck was somewhat stiff on backward motion. The thorax was negative, the lungs clear, and the heart signs normal. The blood pressure was 118/60. The abdomen was negative and there was no tenderness or stiffness in the back. There was some rotation in all joints, most marked in the left hip and right shoulder. The patient exhibited marked crepitus in the large joints and the small joints of the fingers. The left thigh showed considerable forward and lateral bending, which was also present in the right, but less marked.

The patient was given a most exhaustive blood study. The calcium was about normal in all these tests and the other blood findings were also fairly normal. The basal metabolism was +34.

The patient, who remained in the hospital for three months, was afebrile throughout his stay. Studies on his blood chemistry were done during the course of eleven five-day periods, and during each of these periods he was on definite food and some drug intake. The food, urine, stool, and blood analyses at each period were tabulated. These analyses are not yet all completed but the calcium is slightly elevated, the phosphorus normal, and the cholesterol decidedly low, being at one time 95 milligrams. His

icterus index had always been elevated into the zone of latent jaundice, but none of these findings can as yet be correlated, neither can it be said that there was any clinical improvement. However, the patient was put on a high calcium diet and given 50 drops of viosterol per day.

X-ray Examination.—The bones of the skull and all bones except the radius and ulna in both arms and the bones of the spine and pelvis, showed the characteristic changes of osteitis deformans.

This case seems to be of particular interest in that the onset of the disease was at the age of 34 or, at the most, 34½ years, which is rather young for osteitis deformans.

Case 14 The patient, M C, was a white female, 54 years of age. At the age of 50, she had complained of pain in her left hip, which persisted and became worse. It was diagnosed as arthritis. No results were obtained from autogenous vaccine or by diathermy. One year previous to the present examination she was said to have had tuberculosis of the hip, but the present X-ray examination revealed typical changes of osteitis deformans in the bones of the pelvis and left femur. There were also slight changes in the bones of the skull.

Her blood calcium was 11.2. Her Wassermann test was negative, as were the other tests.

On Feb 28, 1930, the patient was put on viosterol, drops 25, three times daily, calcium lactate, gr. 60, twice daily, tomato juice, 6 ounces. This therapy has been continued with the exception, as in other cases in which calcium has irritated the kidneys and bladder, of a period during which milk is alternated with the calcium. The patient has shown definite, though not very marked, improvement in her clinical symptoms. Later X-ray examinations show no change in the bones.

Case 15 S D M, white male, 56 years of age, is not a very intelligent type. He

gave a history of pain of three weeks' duration in his right shoulder, but showed no noticeable change in the size of his head. No other history could be obtained on close questioning. From the appearance of the X-ray films of the right shoulder, a well-established osteitis deformans was found to be present, which certainly had existed for longer than three weeks. Changes also were present in the skull and left humerus, and extensive involvement in the dorsal and lumbar spine, as well as in the bones of the pelvis and the heads and trochanters of the femurs. Slightly less advanced changes showed in the tibias. Therefore, with these X-ray findings, it was apparent that the patient had had this disease for some time.

Blood calcium, 9.8, phosphorus, 3.5, cholesterol, 1.65

June 9, 1930.—He was given viosterol, milk, and tomato juice.

Aug. 1.—The patient returned, feeling much better, although he still had some pain in the arm. Calcium lactate with viosterol was prescribed twice a day instead of three times.

Aug. 22.—The patient had considerable pain in the right shoulder and arm. The pain diminished but stiffness and pain in the back of the neck were present and the patient could not sleep. The régime was continued, with heating and massage to the neck, and luminal, one-half grain, was prescribed for pain.

Sept. 16.—The patient still complained of much pain. The régime was continued with the addition of sodium acid phosphate.

Oct. 1.—Considerable pain and stiffness were complained of. Viosterol, 30 drops, was prescribed instead of calcium lactate.

Oct. 8.—Sodium phosphate was discontinued, otherwise the same régime was adhered to.

Oct. 15.—The patient felt fairly well, the pain was considerably lessened, though

usually it became much worse in warm weather. The régime was continued, except the man was ordered to take clinradol instead of viosterol.

Oct. 21.—The patient was fairly well and felt much better, although he slept poorly. Clinradol was continued.

Oct. 27.—The patient stopped smoking for ten days and the régime was continued. Complaint was made of severe pain and burning in the left shoulder. Blood sugar test was made on Oct. 29, showing 112 mg of sugar.

Nov. 3.—One glass of tomato juice and four glasses of milk per day were ordered. The pain in the left shoulder was still severe.

Nov. 10.—Tomato juice was discontinued and acid phosphate substituted.

Nov. 17.—Tomato juice, calcium lactate, and clinradol were ordered. As sodium acid phosphate made the patient ill, it was discontinued. Complaint was still made of pain in the arm.

He is being continued on treatment.

Case 16 H. B., a white woman, 58 years of age, was admitted to the hospital in December, 1927. She complained of difficulty in walking, had assumed a waddling gait for one and one-half years, and had experienced a feeling of heaviness in the lower limbs for the year preceding examination, with shortness of breath and general weakness.

The family history was negative as was the past history, except for the usual childhood diseases. The patient said that in 1907 she had had an exophthalmic goiter which had been cured by medication and X-ray therapy.

Present Illness.—The patient had been in good health until three years before admission, when she first noticed a slight bowing of the legs, although this did not trouble her in any way. As a child she had not been bow-legged. The bowing gradually increased. Two and one-half years before the present

examination, she noticed stiffness in her legs which usually was present after considerable walking. There was no pain in her legs. This condition continued until about one and one-half years previous to examination, when she had difficulty in walking. She noticed about this same period that she had to get larger sized hats. Otherwise no deformities or pathologic fractures were present and the patient seemed in fairly good health.

X-ray Examination—Several examinations made in 1927 showed very typical changes of osteitis deformans involving the skull, the dorsal and lumbar spine, entire right tibia and head of the left, the pelvis, both femurs, and the heads of the humerus on both sides.

Calcium lactate and acid sodium phosphate were prescribed and the patient's blood calcium is being followed carefully. She has steadily improved on this treatment, has been able to return to work, and is feeling fairly well. The deformities remain the same.

Case 17 C S, white male, 73 years of age, was admitted to the hospital first in 1908 for urinary retention, rectal abscess, and ulceration of the rectum. The abscess was incised. He was re-admitted on Aug 23, 1930, after being struck by a vehicle, when he sustained a laceration of the forehead and contusion of right eye, and was rendered unconscious. After recovery from unconsciousness the man was found to be moderately deaf. He had an unusually large head, the sternum was prominent, and the arteries hard and thickened. Knee jerks were absent. In the phalangeal joints of the hands there was definite enlargement, and the other bones were slightly thickened, with some bowing.

X-ray Examination—The skull, spine, humeri, shoulders, ulnas, tibias, fibulas, and pelvis exhibited the characteristic changes of advanced osteitis deformans. The

femoral and iliac arteries showed extensive calcification, also extensive hypertrophic osteo-arthritis was present.

This patient was treated with calcium lactate and viosterol for a short time and then trace of him was lost.

Case 18 V K, a white man of 39 years, was admitted to the hospital on Dec. 13, 1917, complaining of recurrent fracture of the lower right leg. He said that his shins had always bulged as do the shins of his father and brothers. The bowing had increased markedly in the few years preceding admission to the hospital. About two and one-half or three months earlier the patient had fractured the lower right leg by falling. He was treated and put in plaster, which was removed just a few days before admission. The patient was walking downstairs when he stumbled and his right leg crumpled up under him.

The man's past history is negative except for previous fractures. He had had five blood tests, which were always negative, for specific trouble.

X-ray Examination—Radiograms showed a pathologic fracture due to a very typical change of osteitis deformans.

No further examination was made of this patient and he was treated for the condition. One feels that, though no skull films were made, the changes are in all probability due to osteitis deformans. This is another case in which osteitis fibrosa cystica, particularly in view of the patient's age, cannot be eliminated.

Case 19 Mrs R, white female, 61 years of age. About six years before the present examination, she noted pain and stiffness of her right knee. She recollects back over fifteen years and said that at that time she had had some trouble with her back. She did not know what this was except that it was painful and caused limitation of motion. Her other history and physical findings were negative except for an increase in

pain and disability, with increase in the bowing of her legs. She had also noted that her head was becoming larger. The blood calcium was 9.6.

Treatment was first started on Dec. 17, 1927, being the same as in the other cases, and was continued up to Oct. 27, 1930.

Throughout her illness this patient complained of severe headaches. At times the calcium and viosterol medications relieved them, but at other times nothing was effective except nitroglycerin. This was given in an attempt to reduce her blood pressure on the theory that her headaches might be caused by a dilated blood vessel at the base of the skull where the blood vessels pass into the cranial cavity through the opening which is contracted by encroachment in the foramina by an increase in bony deposits. This medication has been quite effectual.

The patient's condition has remained stationary, except that when she is put on a high calcium diet she feels well and has no pains except the headaches and is able to do a certain amount of her housework. However, as soon as she is on a low calcium diet she becomes much worse.

Radiographs made during the period from 1927 almost to date (November, 1930) have shown practically no change, being typical at all examinations of osteitis deformans.

Case 20 I. L., white, housewife, aged 62 years. The patient complained of pain in leg, and bowing, which had been present for several years. The onset of disease was apparent eight years preceding this examination, with pain in her leg. Three or four years before examination, she had noted a beginning enlargement of her head and a little later beginning bowing of her tibias. For two years there had been pain in her leg and occasionally pain in the arms but no headaches. There had been diminished hearing for two or three years before admission to the hospital, with general weak-

ness and considerable difficulty in walking. X-ray findings of the skull, pelvis, spine, and long bones were very typical of osteitis deformans.

Oct. 7, 1930.—The patient was given viosterol, drops 30, tomato juice and milk, three glasses of each every day.

Oct. 15.—The patient felt much better, the weakness was lessened, the pains diminished, and she said she felt more "limber." Medication was continued.

Oct. 28.—Calcium lactate was alternated with the milk every two weeks. The woman experienced pain in her back and when walking, but otherwise was considerably better and able to do her housework.

Nov. 17.—There were slight pains in the arms and legs, however, the patient was able to walk and to do her housework. The régime was continued except that clinradol was substituted for viosterol.

The patient has continued in fair health up to the date of this report.

Case 21 J. S., a white man, 67 years of age, was admitted to the hospital on Aug. 3, 1930, complaining of diabetes and of urinary symptoms which had been present for three months. For two years preceding admission he had noted enlargement in the size of his head and weakness of the legs. Three months before examination, the patient had noted frequency of urination, increase in appetite, and marked thirst. He had lost 24 pounds during the six months preceding examination.

About two years earlier, or more, the patient's femur had become "lopsided," which the patient claimed was a sudden happening (?) The change was almost as marked then as it was at examination. Shortly after this the patient complained that his legs were heavy and weak, the right more so than the left. He had been told two years earlier that he had Paget's disease.

The family history was negative. The patient had always been in good health ex-

cept for an attack of lumbago, two years before hospitalization. He had a chronic infection in both ears and had been deaf for over twenty years.

Physical Examination—The head was of peculiar shape, sloping in the frontal regions. The eyes, nose, and mouth were negative, as were the neck, lungs, and heart. The abdomen was soft, exhibiting no rigidity. The lower extremities showed definite bowing of the femurs and tibias, the arms showed no deformities though there was some thickening of the humerus on deep palpation. Knee jerks were absent.

X-ray Examination—Examination made on Aug 22, 1930, showed the skull, right humerus, left humerus, and both femurs and tibias to have undergone the typical changes of osteitis deformans.

Further examination showed disturbances of the trabeculae of the lumbar spine and bones of the pelvis, with some evidence of cystic formation and bizarre deposits of calcium so characteristic of osteitis deformans. The patient's blood calcium varied between 0.5 and 1.0. There was no Bence-Jones protein in the urine.

The patient remained in the hospital until Sept 6, 1930. Calcium lactate and viosterol were prescribed, to be taken in a similar manner to the other cases. He was still being treated late in 1930 and showed then some slight improvement.

Case 22 Mrs K B, a white woman, 50 years of age, was admitted to the hospital with a chief complaint of swelling and pain in the right leg and marked headaches which had been present for two or three years. Her physical examination was negative except for some apparent thickening of the bones and a slight bowing of the tibia, and the radiographs showed the typical changes of osteitis deformans. Her blood calcium was 12.3. The other examinations were entirely negative.

May 22, 1928.—The patient was given

calcium lactate, 40 grains, twice a day, calcium hyperphosphate, 30 grains, three times a day, before meals. She returned one week later, saying the pains in her legs were much lessened and the headaches had entirely disappeared. Medication was continued and oscodal added.

June 19, 1928.—The blood calcium was 10.4 and the sugar 96. Medication was continued but, because of nausea, the oscodal was dropped. One month later the blood calcium was 10.8. Calcium hyperphosphate was continued and other medication stopped.

Nov 20, 1928.—The patient complained of "sticking pains" everywhere, and weakness on exertion. Strychnine sulphate, 1/30 gr three times a day, calcium lactate, and tomato juice were given.

May 21, 1929.—Medication was continued and the patient improved steadily.

Nov 12, 1929.—The patient complained of pain in the head and neck and tenderness in the right leg. She had gained in weight, but had not been taking medication for two months.

Dec 10, 1929.—The patient felt much better. The headaches, pain in the leg, and stiffness were no longer apparent but she experienced considerable effort in moving about. Viosterol, gr 30, was given twice daily and other medication was discontinued.

July 1, 1930.—But for slight pain in the right leg, the patient felt very well. Calcium lactate was given, and viosterol was continued, alternated with milk and tomato juice every other day. The patient's progress was satisfactory.

Case 23 J G, a white male, 50 years of age, was admitted to the hospital in June, 1922, entering with a history of fracture of the femur sustained by a twisting motion and not by direct violence. The injury was seemingly trivial but resulted in a fracture.

X-ray Examination—Examination showed a fracture of the femur accompa-

nied by the changes typical of osteitis deformans. The fracture healed without difficulty.

The patient was re-admitted in March, 1930. The history between the previous and present admissions was of no significance except that the patient complained of bone pains and disability when walking. He was unable to stand straight. He also had had considerable pain in his back and had noted stooping and decrease in his stature. These changes had been very gradual during the four years preceding the present examination. Eight days earlier he had awakened with severe pain, which lasted for two hours, in the hip and lumbar region. This severe pain soon subsided but a continual ache persisted for that day. No numbness or other changes were noted except deafness in the right ear.

Physical Examination.—The patient was a fairly well-nourished individual of slightly vacant facial appearance and stooped posture. He had a very large head and his face was slightly triangular. The legs showed no apparent bowing, the back was slightly bent, the sternum prominent, the lumbar region flattened, and the teeth rather poor. The neck showed no glandular enlargements. The heart examination was negative, the lungs, clear, the abdomen, negative. All reflexes were present.

X-ray Examination.—Radiographs made on March 4, 1930, showed the bones of the lumbar spine, hip joints, and pelvis to have that lacy appearance of bone with bizarre calcific deposits scattered throughout, and some cystic formation, which is typical of osteitis deformans. The old healed portion of the upper part of the shaft of the femur was clearly seen. There was also bizarre arrangement of the bone trabeculae.

All laboratory tests were negative. The patient had low blood calcium content and was referred to Dr. Bernheim's clinic for

Case 24 Mrs. T., aged 50 years, who was referred to the hospital for radiographic examination, had been a missionary in the Philippine Islands for years. For a considerable period of time she had suffered from what she termed "rheumatism" for which she received varied medication without relief. A complete history of this case was not secured owing to the fact that the patient was referred for radiographs only and left for the Philippine Islands shortly after the examination. She has since been heard from through her physician, who states that her condition is becoming progressively worse. Her pains are about the same, but her disability is increasing and she finds walking correspondingly difficult.

X-ray Examination.—The films showed changes in the bone to be a fibrous cystic degeneration. The bone trabeculae were arranged in longitudinal bundles, and were mottled by areas of decreased density, indicating absorption of calcium, and also a suggestion of beginning cystic formation. The rather unusual feature in this case was that the hands showed an involvement in one of the first metacarpal bones. The skull showed no evidence of the changes of Paget's disease.

Due entirely to the lack of involvement of the skull, this might be classed with Case 26 as a doubtful case of osteitis fibrosa cystica of the generalized type; however, the authors do not feel that this lack excludes Paget's disease. Due to the patient's age and the fact that her symptoms have been present for not more than six or eight years, it would seem that this is a case of Paget's disease without involvement of the skull.

Case 25 F. D., aged 41 years, while walking fast, fell over a low table, causing a fracture of the left femur. For about six months previous to the injury he had noted in the right leg a slight pain in the

localize, he thought it was probably rheumatic. The pain seemed to disappear when he exercised. Previous to the injury he had felt tired and slightly under par, he also had had continuous headaches for some six months. There was no family history of similar pains, the father died of rheumatism, the mother, of shock. The patient had had uniformly good health save for childhood diseases and occasional attacks of tonsillitis. His personal history was irrelevant.

The patient presented slight bowing of both legs, particularly of the femurs, and since he had sustained the fracture he had had to walk with a cane. His left knee was slightly limited in motion but there was no stiffness of the hip. Apparently his height had not undergone change. His skull showed slight thickening over the occipital protuberance and was rather large and square in appearance, but the face was fat, so that it did not have the typical triangular appearance.

X-ray Examination.—Radiographs revealed marked osteitis of the left femur, with the pathologic fracture, in addition, the bones of the pelvis and the upper half of the right femur were similarly involved. Also, changes in the lumbar spine and the posterior portion of the skull in the occipital and occipitoparietal regions showed definite thickness, with abnormal distribution of the trabeculae. In the parietal regions there was a suggestion of a beginning typical appearance, as described by Baetjer. These findings were interpreted as due to Paget's disease.

Summary.—This case shows essentially the same X-ray findings as were noted in the following case, but here the skull did show changes, so that again the question arises as to which classification should be applied. One school would claim that this was unquestionably a case of Paget's disease

because of the involvement of the skull. The other school would claim that there is no case of true osteitis deformans without the involvement of the skull, yet the changes in the long bones, the pelvis, and the spine in this case and the one following are very similar.

Case 26. H. P., aged 52 years, was admitted to the hospital on July 13, 1915. On the evening of admission the patient was standing on a window-seat 18 inches above the level of the floor. He was holding a heavy curtain, and, in attempting to step from the window-seat to the floor, his foot slipped and he fell to the floor, from which he found it impossible to rise. He had very little pain but knew from the deformity that his thigh was broken. The patient had always felt that the right leg was not so strong as the left, when he was a child he had noticed that he could not do things with the right leg which he could with the left. When he was about 30 years of age, he had had an accident, with resulting contusion of the right leg. Later two abscesses developed near the tibia, which necessitated treatment for two months, during most of which time he was confined to bed. The patient said that for some seven weeks previous to admission he had had rheumatism and pain in the bone in his right thigh, the pain being especially severe in the anterior muscles over the middle third of the thigh. The pain was made better by resting and was less severe at night. There was also more pronounced weakness in the right thigh than previously. He walked with a slight limp, and used a cane because he felt the leg could not support him. The past history was otherwise negative and the family history was irrelevant.

Physical Examination.—The examination was negative except for the right leg, which showed no evidence of contusion or external violence. The limb was held in external

rotation. There was marked anterior bowing just above the middle of the thigh, and extreme tenderness in this region. A mass was felt, apparently the upper fragment of the fracture, which was palpable anteriorly. A corresponding mass was felt posteriorly. There was crepitus on motion. The right leg was one inch shorter than the left.

X-ray Examination.—Examination showed pathologic fracture of the right femur, with bony changes indicating an osteitis. These changes consisted in a disturbance of the bone trabeculae, osteoporosis, and cystic formation in the cortex and medulla, with some evidence of periosteal bone production and a widening and bending of the bone.

The patient was afebrile throughout the course of his convalescence from the fracture. His urine was practically always normal and his blood count showed nothing unusual. The fracture healed satisfactorily and the patient was discharged as cured on Nov 4, 1915.

On Jan 1, 1916, the patient was readmitted with the following history. A few minutes before admission, while he was getting off a train, his crutch slipped, and he fell a distance of two steps, striking his right heel with considerable force. His thigh became very painful at the site of the old injury and there was an apparent deformity. On admission, the deformity and swelling were clearly seen, and tenderness was apparent. The history was as recounted above on the previous admission.

X-ray Examination.—At this time the films showed a recent pathologic fracture at or near the site of the previous fracture, the changes being the same as in the previous examination except that the condition seemed still more advanced and was complicated by callus formation about the old fracture. Nothing else of interest was found in the history. The patient was dis-

charged on February 9 with a firmly united fracture.

Oct 17, 1916, he was again admitted to the hospital with another fracture of the right femur near the site of the two previous pathologic fractures. There was nothing further of interest in his history except that this fracture was sustained, as in the previous instances, with a minimum amount of trauma, namely, that he missed one step and the resulting jar caused the injury. The X-ray examination at this time showed distinct advance in the pathologic changes in the bone, and the left tibia showed the changes noted in Paget's disease. His blood calcium was never estimated. The blood count was normal, as was the urine analysis. The blood pressure was within normal limits for a man of his age.

Summary.—This is one of those cases in which it is a question as to what classification is to be applied. The X-ray examination and the patient's history show an osteitis involving numerous bones of the body. The condition is progressive, as the patient was again examined roentgenographically in February, 1927.

This case, however, has never had involvement of the skull. Also, the patient has given a history of slight disability in his right thigh since childhood, including abscesses on the leg. The question arises: Is this case one of so-called osteitis fibrosa which the patient had for some forty years before sustaining pathologic fractures and in which the skull has never been involved? On the other hand, are we to class this as a case of osteitis deformans without involvement of the skull, and are we to consider that the previous disability and weakness of the right thigh and the previous infection were in no way related to the present bone disease? It seems that this case is one of those that simply cry out for further investigation.

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RADIATION TREATMENT OF UTERINE HEMORRHAGE OF BENIGN ORIGIN¹

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ELEVEN years ago last January, I began to treat certain selected cases of uterine hemorrhage by radiologic methods. The early cases responded in such a uniformly satisfactory manner that in a short time we were using radiation in a fairly large number of cases that had formerly required major surgical operation for relief. In this paper I wish to present briefly a study of some of the difficulties encountered, the methods used, and an analysis of the end-results of the whole series. Due to the fact that the management varies a great deal with the type of case, I wish to divide them into three groups.

1 Young women under 35 without tumor or other demonstrable pelvic disease who resisted conservative treatment and continued to bleed excessively. In this group there are 10 cases the records of which are complete. This type of patient was studied carefully, medical measures and curettage were tried before radium was advised, and it was only in the exceptional case that we found the use of radiation necessary. The treatment of this type of case consisted of the intra-uterine application of small doses of radium—200 to 400 mg.-hrs being sufficient. The results have been uniformly good. All patients have been promptly relieved of their excessive bleeding and there have been no unpleasant complications. One patient returned after a period of five years with excessive bleeding, and she is at present under observation.

2 The second group includes the patients who were near or past the usual age for the menopause, who had no demonstrable tumor or inflammatory disease to account for their hemorrhage, but who continued to bleed excessively in spite of con-

servative medical management. Their condition is commonly styled hemorrhage of the menopause and is said to be due to fibroid of the uterus or metritis or endometritis. In this group of patients there are 31 cases, with an age range of from 40 to 57 years. The treatment of this type of case differs considerably from the others, since the only object of treatment is control of the hemorrhage. Small doses of radiation are usually all that is needed, and X-rays and radium act equally well. The average dosage of radium is 1,000 milligram-hours. One cycle of X-ray therapy is usually sufficient. The following case was exceptional, and the only one in this group that presented any unusual difficulties.

Mrs H, age 57 years, consulted me on October 26, 1926.

History.—For several years her periods had been irregular. Twenty-two months previous to examination she began to bleed, and continued to flow in small amounts. She complained of pain in the back and legs. She gave no history of other illness except an occasional attack of asthma. She had never been pregnant.

Physical examination, aside from evidence of a considerable degree of anemia, was quite negative. Vaginal examination disclosed a retroverted uterus, but normal in size. There was no other pathology found in the pelvis. The cervix appeared normal. X-ray therapy was advised and monthly doses of moderate voltage X-ray were administered. The bleeding promptly ceased but recurred in small amounts at irregular intervals.

Her subsequent history reads as follows: "March 1, 1927 (five months after starting treatment)—Had a slight hemorrhage a few days ago. Has had very little bleeding the past two months. Examination negative."

¹Read before the Cascade County Medical Society of Great Falls, Montana March 21, 1931

"August 10, 1927—Has brownish discharge, slight bleeding at irregular intervals
Examination negative

"October 28, 1927—Slight bleeding past few days

"January 17, 1928—During past month the patient has had considerable bleeding. Curettage and radium treatments were advised. Pathologic report, endometritis. Results, complete cessation of bleeding."

This patient was quite well for one year following X-ray therapy except for occasional slight bleeding. She declined further treatment until hemorrhage again became severe. The end-result was entirely satisfactory and she has remained well to date.

3 The third group is composed of the fibromyomas and in this group there is still room for study and discussion as to the best mode of treatment. In January, 1931, Dr E H Zweifel, of Munich, in his Mayo Foundation Lecture entitled "Treatment of Fibromyoma by Roentgen Rays," says "Ten years ago when I wrote a paper on this subject, I thought the discussion practically finished, but it is not, even yet, and further experience has led me to open the discussion once more." He states as his conclusions that irradiation of myomas is the treatment of choice. With careful diagnosis and selection of cases, it presents the least risky way to recovery.

Francis Carter Wood, in the *Journal of the American Medical Association*, March 1, 1930, says "Many uncomplicated fibromyomas are still removed surgically which could perfectly well be treated by X-rays. The advantages of X-rays are lack of risk, simplicity of treatment, certainty of results, and low cost to patient."

Certain cases are undoubtedly best treated by surgical operation, while others can be definitely placed in the group in which radiation is the treatment of choice. In the borderline cases in which the complete diagnosis is in doubt, there will always be a divergence of opinion as to the best form

of therapy. Such divergence of opinion is at the present time great. One prominent gynecologist states that the treatment of fibromyomas by X-rays is useless and exercises a harmful effect on the general endocrine activity and metabolism. He recommends panhysterectomy in all cases, but admits a mortality of 5 per cent. Certain German gynecologists irradiate a very large percentage of their cases. A prominent French authority (Beclère) made the statement that a myoma of the uterus always constitutes an indication for radiation therapy. During a seven-year period, at St Luke's Hospital, New York City, 1,443 myomas were operated upon. During the same period, 20 cases were referred to the Radiotherapeutic Department for treatment. In the gynecologic service of the University of Pennsylvania, during a five-year period, 681 cases were treated. Of these, 428 were treated by surgery, and 253 by radiation. Our records show a total of 288 cases treated since we began to use radiation treatment. During this same period, 20 uterine fibromyomas were operated upon by Dr Movius. There has been no mortality in this entire group.

In deciding which type of case is best operated on, it is generally agreed that very large, necrotic, or calcified tumors are best treated by surgical removal. Pedunculated and submucous growths are at times resistant to radiation and may constitute an indication for surgery. Tumors occurring in comparatively young women, in whom it is possible to preserve the major portion of the uterus, are best treated by surgery.

Less than two years ago I was asked see a patient who had a large fibroid. She was about 40 years of age, had been married only a short time, and was very anxious to have a child. I advised operation, which was performed. This patient is now near term and has every indication that her pregnancy will terminate successfully. Radiation would almost certainly have destroyed her reproductive function.

Mention may be made at this time of one patient who came under my care in 1927. The woman, who was 35 years of age, had a fibroid the size of a small orange, and had had severe hemorrhages. She was given two moderate dosage X-ray treatments which controlled her bleeding. Last April (three years after treatment) she was referred to me by the late Dr Thuerer for examination of her abdomen to determine the nature of a large abdominal tumor. X-ray examination disclosed the presence of three fetuses. Unfortunately she aborted at approximately the fifth month. No evidence of any fibroid tumor could be found.

The question of a possible malignant growth being present in addition to the myoma is one that must have due consideration. Carcinoma of the body of the uterus is best treated by complete hysterectomy, and the radiation commonly used for fibromyoma will have little or no effect on carcinoma. The incidence of carcinoma complicating myoma as drawn from extensive pathologic records is about 0.5 per cent. It is our experience that carcinoma can usually be excluded by a careful history, as the bleeding from carcinoma is as a rule slight, irregular in character, and accompanied by a watery discharge. Diagnostic curettage is used only in doubtful cases and followed immediately by radium treatment. We have not, to our knowledge, treated any cases of carcinoma under a mistaken diagnosis of myoma. Sarcoma complicates myoma in less than 1 per cent of all cases examined pathologically, which is considerably less than the average operative mortality from hysterectomy. We have had no experience with this condition. Of the 268 cases treated, 22 were between 50 and 60 years of age, 202 between 40 and 50, and 67 under 40. Of these, 24 had tumors classed as very large, extending well up into the abdomen, in several instances reaching as high as the umbilicus, 244 had intrapelvic myomas of which 162 were classed as large,

moderate, practically filling the pelvis, and 82 were small, about the size of an orange. Symptoms, aside from hemorrhage, which was present in most cases, were pain, pelvic and abdominal, in 41 cases, backache in 50, shortness of breath in 10, severe headache in 30. In two patients, pressure on the bladder was sufficient to interfere with urination. In that they did not complete the treatment as outlined and went elsewhere for operative treatment, 6 patients are classed as incomplete. One patient, whose history is as follows, was a failure as far as radiation treatment was concerned.

Mrs J., age 42 years, complained of profuse menstruation which had begun 18 months previous to examination. The flow had lasted from 8 to 14 days, and at the time she came for treatment she had been flowing for three weeks. On examination, a myoma the size of an orange was found. X-ray treatments were given in October, November, and December, 1927, and January, 1928, with very little effect. She was advised to have a curettage and intra-uterine radium treatment, which were done, but the bleeding continued, and hysterectomy was finally performed. The examination of the uterus showed a small submucous fibroid about the size of an egg, very hard and fibrous in character, which apparently acted as a foreign body. This patient made an uneventful recovery.

Another patient who was resistant to X-ray therapy was Mrs C., referred by Dr Armstrong. She was a woman past 50 years with a tumor that nearly filled the pelvis. Her periods were heavy, and she had a moderate degree of anemia. X-ray therapy was started in January, 1926, twelve X-ray treatments being given during the year. The excessive bleeding promptly responded to the treatment, but she continued to menstruate a small amount. At the end of the year, I urged diagnostic curettage and radium treatment but these were declined. Dr Armstrong said the tumor had dis-

"August 10, 1927—Has brownish discharge, slight bleeding at irregular intervals
Examination negative

"October 28, 1927—Slight bleeding past few days

"January 17, 1928—During past month the patient has had considerable bleeding
Curettage and radium treatments were advised
Pathologic report, endometritis
Results, complete cessation of bleeding"

This patient was quite well for one year following X-ray therapy except for occasional slight bleeding. She declined further treatment until hemorrhage again became severe. The end-result was entirely satisfactory and she has remained well to date.

3 The third group is composed of the fibromyomas and in this group there is still room for study and discussion as to the best mode of treatment. In January, 1931, Dr E H Zweifel, of Munich, in his Mayo Foundation Lecture entitled "Treatment of Fibromyoma by Roentgen Rays," says "Ten years ago when I wrote a paper on this subject, I thought the discussion practically finished, but it is not, even yet, and further experience has led me to open the discussion once more." He states as his conclusions that irradiation of myomas is the treatment of choice. With careful diagnosis and selection of cases, it presents the least risky way to recovery.

Francis Carter Wood, in the *Journal of the American Medical Association*, March 1, 1930, says "Many uncomplicated fibromyomas are still removed surgically which could perfectly well be treated by X-rays. The advantages of X-rays are lack of risk, simplicity of treatment, certainty of results, and low cost to patient."

Certain cases are undoubtedly best treated by surgical operation, while others can be definitely placed in the group in which radiation is the treatment of choice. In the borderline cases in which the complete diagnosis is in doubt, there will always be a divergence of opinion as to the best form

of therapy. Such divergence of opinion is at the present time great. One prominent gynecologist states that the treatment of fibromyomas by X-rays is useless and exercises a harmful effect on the general endocrine activity and metabolism. He recommends panhysterectomy in all cases, but admits a mortality of 5 per cent. Certain German gynecologists irradiate a very large percentage of their cases. A prominent French authority (Beclère) made the statement that a myoma of the uterus always constitutes an indication for radiation therapy. During a seven-year period, at St. Luke's Hospital, New York City, 1,443 myomas were operated upon. During the same period, 20 cases were referred to the Radiotherapeutic Department for treatment. In the gynecologic service of the University of Pennsylvania, during a five-year period, 681 cases were treated. Of these, 428 were treated by surgery, and 253 by radiation. Our records show a total of 288 cases treated since we began to use radiation treatment. During this same period, 20 uterine fibromyomas were operated upon by Dr Movius. There has been no mortality in this entire group.

In deciding which type of case is best operated on, it is generally agreed that very large, necrotic, or calcified tumors are best treated by surgical removal. Pedunculated and submucous growths are at times resistant to radiation and may constitute an indication for surgery. Tumors occurring in comparatively young women, in whom it is possible to preserve the major portion of the uterus, are best treated by surgery.

Less than two years ago I was asked see a patient who had a large fibroid. She was about 40 years of age, had been married only a short time, and was very anxious to have a child. I advised operation, which was performed. This patient is now near term and has every indication that her pregnancy will terminate successfully. Radiation would almost certainly have destroyed her reproductive function.

RADIOTHERAPY WITH SMALL QUANTITIES OF RADIUM

A PRACTICAL TECHNIC

By PAUL O SNOKE, M.D., LANCASTER, PENNSYLVANIA

From the X-ray Department of the Lancaster General Hospital

THOSE radiologists not working in the large centers frequently feel that the practical and clinical aspects of radiotherapy are being forgotten by those concerned with scientific research. The practising radiologist is concerned with clinical results and the manner in which they may be obtained with his small quantity of radium. We deem it timely to correlate the highly

sylvania, with a different technic, is securing. It would seem that the amount of radium available has very little to do with the results, but, rather, that the manner of its application is all-important.

We have available at the Lancaster General Hospital 75 milligrams of radium, these limited resources making it necessary to prolong the treatment time—not a disadvantage, as Regaud has shown. We do not use in every case the heavy filtration he advocates, but attempt to vary it, increasing the filtration as the depth of the lesion increases.

If we, as practical radiologists, can select a technic using small quantities efficiently, we can achieve as brilliant results as have been obtained in the centers devoted to scientific investigation, with the splendid advantage of individualization. We venture to report our methods in the hope that they may aid in the adaptation of scientific fact to practical therapy.

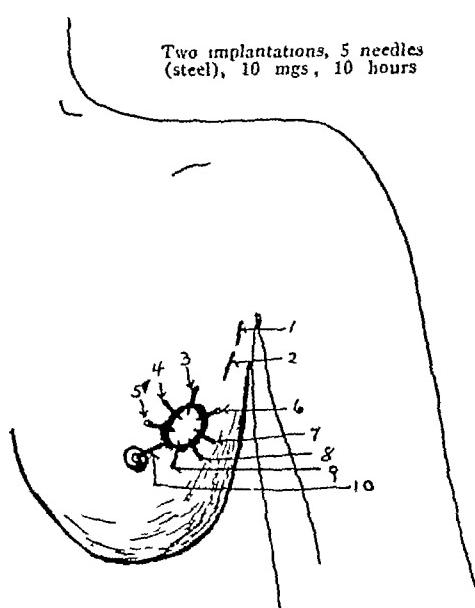


Fig. 1 Mapping of carcinoma of the left breast, 4.5 X 3 X 3 centimeters

scientific with the practical aspects of the problem. Unfortunately in many reports the statistical data so hide the technic of treatment that, though one reads his periodicals, he still fails to appreciate the necessary details.

If we study these periodicals we find that Forssell (1) and Berven and Heyman (2), in Stockholm, and Bowing (3), at the Mayo Clinic, are achieving the same percentage of five-year cures in carcinoma of the cervix that Norris (4), at the University of Penn-

INTERSTITIAL RADIATION

Before undertaking any radium implantation the lesion is mapped and measured (Fig. 1). From a sketch made at this time the location of each needle is predetermined, also fatty tissue and bony structures are considered. The needles, measuring 1.5 mm X 2.7 cm, with a wall thickness of 0.4 mm steel, are so arranged that their points are 1.2 cm apart after insertion. They are implanted in one plane unless the lesion is so thick that two planes are required. This is rarely the case, for we can resort to radial implantation, using the tumor as a hemisphere or sphere, pointing the needles toward the center.

peared and he saw no reason for further treatment. This patient's menstruation ceased entirely after a few months and she has since remained well.

There have been two cases in which the size of the tumor has not been satisfactorily reduced and operation has been performed for removal of a large tumor, after the hemorrhage had been controlled and the patient's general condition markedly improved.

In order to meet the needs of the individual patient, the methods of treating myoma by radiation are necessarily varied. Severe bleeding usually calls for a moderate dose of radium as this will almost invariably cause a prompt arrest of the hemorrhage. When the tumor is large it is necessary to follow the radium treatment with moderate doses of X-rays at intervals of from ten days to two or three weeks, over a period of about three months or longer, in order to secure a satisfactory reduction in the tumor. Until 1928, a large portion of my cases were treated with an old type 10-inch machine which I have since found will deliver only 100 KV at the altitude in Billings. A few cases have been treated with voltages as high as 200 KV and filters of 0.5 mm copper. There is apparently very little advantage in the larger doses and higher voltages as far as the tumor is concerned and the patient does not tolerate the higher voltage so well. My present technic consists of 150 KV, 0.25 mm Cu, about 300 r applied alternately to front and back every ten days. I usually give eight or more treatments. This plan of treatment causes the patient to experience little or no reaction or inconvenience of any kind. Patients who live a long distance from Billings are usually advised to take 1,600 mg-hrs of radium in order to minimize the number of trips necessary to secure satisfactory results. Patients are re-examined after six weeks of treatment, and at monthly intervals

thereafter. Treatment is continued until the tumor has been reduced at least 50 per cent in size, and longer, if the size of the tumor appears to be causing symptoms.

That a gradual reduction of the size of the tumor goes on for a long time after treatment is discontinued has been repeatedly proved by our own observation. One of my early cases was a striking illustration of this. This patient had a large, hard fibroid reaching nearly to the umbilicus. Treatment promptly stopped hemorrhage and the tumor became smaller. After about seven months of treatment the patient was practically symptom-free. Reduction in the size of the tumor was estimated at about 40 per cent. The patient moved away at this time but she returned for observation after one year. During this year she had had no treatment. Examination at this time showed a complete disappearance of the tumor.

Skin reactions are few, and cause little or no trouble. Some patients complain of nausea, but this is less since we have shortened our treatment time. The usual nervous manifestations of the climacteric are to be expected, apparently differing little or none from those seen at the natural menopause. Many patients ask the question, "Won't this treatment make me an old woman?" My reply is that, on the contrary, it is the best method we have of rejuvenation.

SUMMARY

A total of 309 cases of uterine bleeding have been subjected to radiation treatment. One case resulted in complete failure. In two cases the bleeding was controlled, but subsequent operation was necessary for removal of the tumor. Six cases discontinued treatment before a complete series had been administered. In 300 cases a satisfactory result has been achieved.

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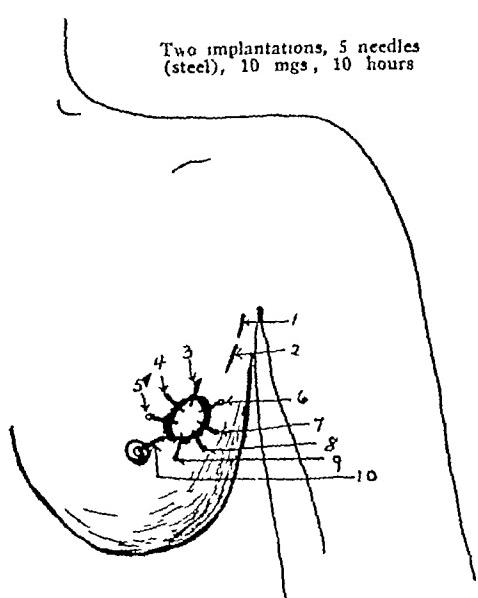


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The patient is given a general anesthetic, preferably gas. Local anesthesia is disadvantageous because of the danger of opening lymph channels for metastatic invasion. Block anesthesia is very good, but it is not

tion, depend upon subsequent irradiation to control it.

Our needles are threaded with fine non-corrosive wire, this in preference to silk thread, which is uncertain because it breaks

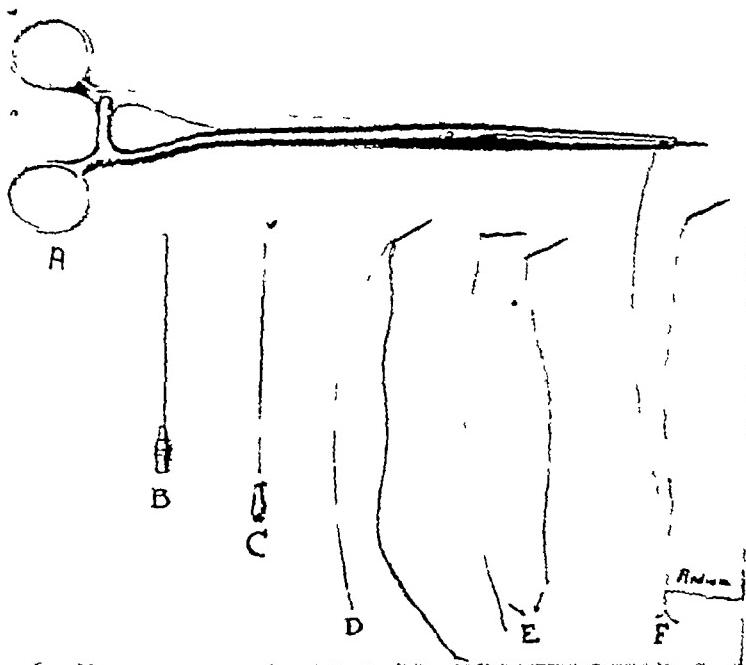


Fig 2. (A) Needle holder, with needle in position for implantation, (B) Cannula, (C) Trocar—note the flat sides which permit egress of the wires, (D) Needle threaded with black silk and wire, (E) Two needles threaded with wire, (F) Needle threaded with white silk for superficial work.

applicable to all locations. The skin is prepared as for a major operation and all aseptic precautions are observed. A bistoury is used to incise the skin, and through this small incision the needle, held in a needle holder as a spearhead on a spear, is plunged directly into the carcinomatous mass. Trocar and cannula are used in very deep lesions in which one must traverse normal areolar tissue (Fig 2).

We attempt to reach the palpable border of the neoplasm, embedding one-half the needle length in the neoplasm. This serves to hold the needle firmly and catches outlying groups of carcinoma cells. We are not unmindful of Handley's microscopic growing edge, but, in view of its uncertain loca-

too easily and in most embarrassing situations. In intra-oral work the needles are threaded with wire and black silk. With the silk they are sewn *in situ*. In treating large lesions in which more than five needles are necessary, the implantation is done in two stages, re-implanting upon removal.

Each of the needles contains 10 mg and is permitted to remain *in situ* ten hours, i.e., 100 mg -el hours.

DANGERS AND EXCEPTIONS

Needle implantation is never undertaken through an ulcerated or infected surface. Intra-oral work requires chemical sterilization of the field before insertion. Infection carried into the depths of an actively

growing carcinoma is certain to lead to increased rapidity of growth

Displacement of a needle after insertion is a serious matter, as proximity to the skin for the full time will cause a severe burn

prevent this misfortune. Occasionally in implanting radium needles a sensory nerve lies along the course of the needle and receives maximum radiation. This causes most excruciating pain of months' duration, for

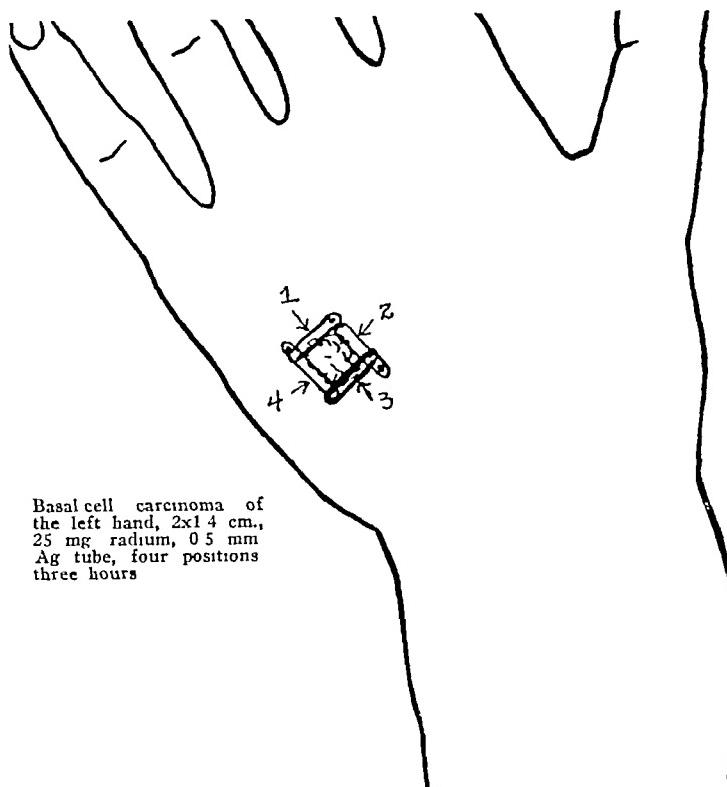


Fig 3 Superficial carcinoma of the hand, mapped after biopsy

As a precautionary measure the wires projecting through the puncture wounds are fastened with adhesive plaster, sterilized in a lamp, at their point of exit through the skin. Dressings and bandages are applied over this. Care must be exercised in implanting if nodules are subcutaneous—the time must be reduced or the needle implanted deeply so that the lesion lies between the needle and the skin.

Fatty tissue and bone must not be heavily irradiated if avoidable. There is danger of fat necrosis and bone devitalization (5), both of which are unpardonable sins. Only painstaking care and good judgment will

afford relief.

Tonsillar lesions require 80 mg -el -hrs as the lymphoid tissues are usually radiosensitive and there is danger of sloughing and hemorrhage. The grading of the dose is a matter of judgment which depends on the type of growth and its comparative radiosensitivity. Only a few reports are available which are of scientific value, notably Quimby and Martin's (6). Modern therapy demands this type of work.

Although we are using steel filtration, we contemplate changing to platinum, 0.5 mm wall thickness. The increased filtration re-

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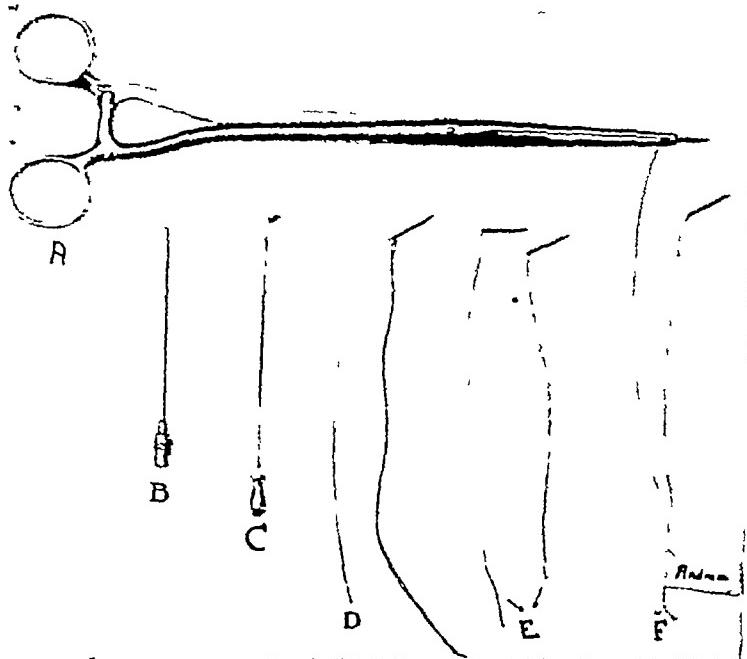


Fig. 2 (A) Needle holder, with needle in position for implantation, (B) Cannula, (C) Trocar—note the flat sides which permit egress of the wires, (D) Needle threaded with black silk and wire, (E) Two needles threaded with wire, (F) Needle threaded with white silk for superficial work.

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Needle implantation is never undertaken through an ulcerated or infected surface. Intra-oral work requires chemical sterilization of the field before insertion. Infection carried into the depths of an actively

duces the beta radiation, and we are very certain that gamma radiation is more to be desired than beta

be called to cases of metastatic malignancy in the cervical lymph nodes, *e.g.*, from a primary lesion of the tongue. Occasionally the

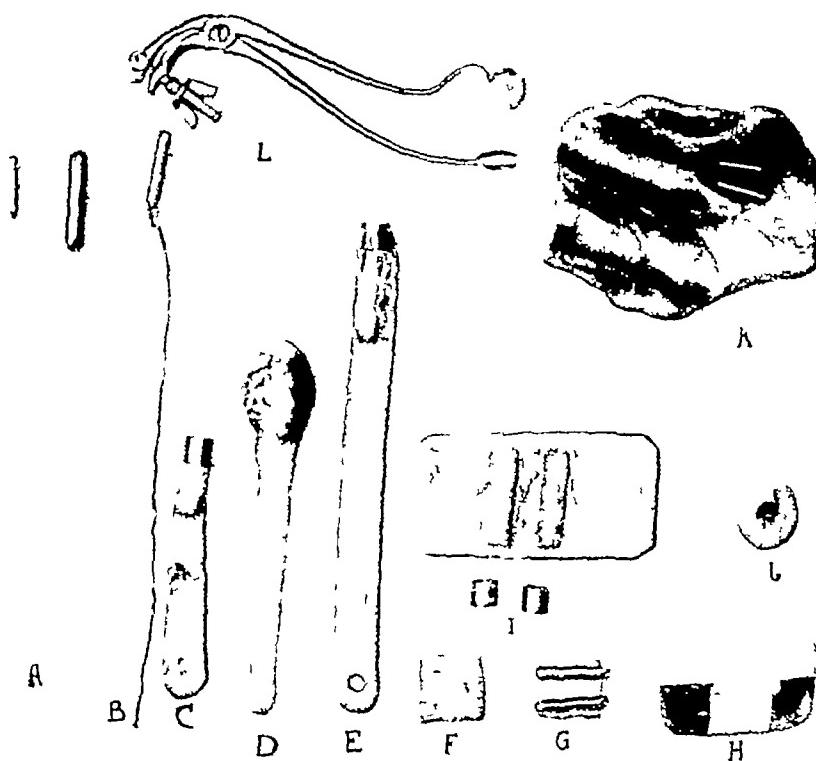


Fig. 4. (A) Small capsule 0.5 mm., silver filter for 25 mg. glass capsule, large capsule, 2 mm. of brass for five 10-mg. needles, (B) Capsule for five 10-mg. needles, wall thickness 1 mm., one brass wire and silk for cervical work, (C) Lead capsule for intra-oral work, 3 mm. wall, (D) Lead spoon for palatal applications, (E) Lead capsule with handle for deep intra-oral lesions, (F) Cork block 2.5 X 2.5 cm., 2 cm. thick, (G) Two brass capsules on a cork block 1 in. thick, (H) Wooden block 2.5 cm. cube on a celluloid base, (I) Two lead capsules 3 mm. wall thickness for deep-seated lesions, (J) Cervical cork for vaginal applications, (K) Moulage of irregular lesion distal to hypotenar eminence—lesion painted black, dummy tubes of wire visible, (L) Tonsil clamp, for topical applications to tonsil and adjacent structures

SURFACE RADIATION

After having observed bare tubes, gold tubes, and steel needles generously implanted in carcinomas, we are convinced that the indications for interstitial radiation are daily becoming more circumscribed. We feel that operative interference with inoperable carcinoma opens avenues of infection, lowers the resistance of the host, and damages local resistance. Attention need only

surgeon attempts a block dissection of the neck but on exposure finds that nodes apparently free-lying before operation are hopelessly embedded, making resection impossible.

Our experience has been that although these patients get primary skin union the neoplasm takes on added malignancy and the termination is hastened, in spite of the fact that only the skin and superficial fascia have been disturbed. In such extensive dis-

ease external radiation offers the best chance for control Interstitial radiation would require multitudinous emanation implants evenly distributed A trial of this method suffices to convince one that the homogeneous distribution of radiation in three planes is indeed theoretic

Surface radiation has great possibilities, more especially so since the introduction of high filtration Forssell (7) classifies lesions of the skin as superficial and infiltrating This is applicable and may be carried with advantage to other locations Further clarity may be secured by subdividing these two as follows

(A) Superficial
 Ulcerating
 Non-ulcerating

(B) Infiltrating
 Ulcerating
 Non-ulcerating

Superficial Non-ulcerating Lesions—These are best treated with a filtration of 0.5 mm Ag and 1 mm of rubber We do not wish to produce ulceration by our treatment, therefore we encase our 25 mg silver capsule in rubber tubing—wall thickness, 2 mm—which serves to remove the secondary radiation of the silver Silver, 0.5 mm, removes 25 per cent of the beta radiation, the remaining 75 per cent and the gamma rays being effective The erythema time is 50 mg -el -hours

The silver tube is applied to skin lesions with adhesive plaster The lesion is measured, mapped, and photographed, and a time plan of radiation made (Fig 3)

Superficial Ulcerated Lesions—These are treated with the naked silver tube, and, as before, it is applied on adhesive plaster or a moulage, after mapping This radiation is the most caustic used in treatment

Although the erythema time is 35 mg -el -hrs, we routinely give 75 mg -el-hours Quimby's erythema (8) is a faint blush on the skin of 80 per cent of a group of normal

individuals after fourteen days In treating carcinoma, we are not satisfied with "faint blushes"—we desire maximum effects compatible with reparative processes, *i.e.*, the epidermicidal dose We omit the rubber because the ulcerating carcinomatous surface affords this filtration for the deeper structures which we wish to treat, and aids by destroying superficial cells by caustic lysis

Dangers—The application of radium in this form adjacent to cartilage, *i.e.*, the ear, will give rise to a perichondritis This is painful, very difficult to heal, and always to be avoided In locations in which cartilage is subjacent, surgical diathermy offers the superior method of treatment

Because repeated small doses have a tendency to produce a chronic ulcer with a fibrous base, it is important to avoid them This is evidence of inadequate primary treatment, and the resulting type of ulcer is malignant, non-healing, and unresponsive to any type of therapy Electrocoagulation offers the best chance for cure Surgical intervention results almost invariably in a severe cellulitis or erysipelas The malignant cells seem to be enmeshed in a fibrous matrix, the growth impulse held in abeyance, insufficient nourishment reaches the surface so that infection cannot be coped with nor healing occur A disturbance of this symbiotic community leads to rebellion and the rapid increase of one or the other element, failure to attack the lesion leads to slow but sure malignant progress

Infiltrating Ulcerated Lesions—With the quantity of radium at our disposal we can prepare a 50 mg capsule, wall thickness 1 mm or 2 mm, and a 25 mg capsule with the same wall thicknesses Higher filtrations can be obtained by having lead capsules made We are using 3 mm of Pb

Capsules are used primarily in the infiltrating lesions, being encased in 2 mm rubber tubing when they are used in contact Experience alone can aid one in a decision

as to when to apply capsules in contact and at a distance. In general, however, in lesions of the mouth or in body cavities, they must perforce be used in contact, whereas in surface lesions space is available for distance therapy.

Various applicators are available for intra-oral work, of which the lead spoon, the center-board holder, and the tonsil clamp are the best known (Fig. 4).

With 1 mm brass, 2 mm rubber filtration, the erythema time is 64 mg -el -hours. Practically, we give 100 mg -el -hrs plus. This dosage can be repeated every other day until 400 to 600 mg -el -hrs are given. The reaction is very severe, requiring six weeks for healing. With these intra-oral applicators, fixation cannot be rigid, so that the area treated is not accurately computable, this accounts in a large measure for the huge dosage one may give with comparative safety.

Lesions situated about the eye necessitate protection of the eyeball. Lead plates 2 mm thick are cut to fit the conjunctival sac, hammered until they fit the curvature of the eyeball, smoothed, and polished until they are flawless. After cocainizing the eye these are slipped into the conjunctival sac before the treatment is started.

RADIUM IN THE CERVIX UTERI (CARCINOMA)

The naked 1 mm brass capsule containing 50 mg is used with a semi-flexible brass wire through its eye. This is inserted in the external os after biopsy and chemical sterilization of the surface. The vagina is packed tightly. The knee-chest posture aids greatly and an intra-vaginal light is indispensable. The dose is 50 mg given for 16 hours, a total of 800 mg -el -hours.

After 48 hours, a second application is made and, if the canal is patent, the 25 mg capsule in brass precedes the large capsule in an attempt to reach the fundus. The

50 mg capsule is placed in a midcervical position. Again 16 hours is given. A third similar treatment is given after the 48-hour interval, the total intracervical dosage being 2,400 mg -el -hours. If the 25 mg capsule will enter the fundus, an additional 800 mg -el -hrs may be added to this.

Vaginal applications follow at 48-hour intervals. A cork 2.5 cm in diameter is bored to take a 50 mg lead capsule of 3 mm. wall thickness. This is used in the three positions—right, left, and across, or the H series. The erythema time is 800 mg -el -hours.

This is the technic advocated by Bowing (3) with modifications and is excellent for those who possess only small quantities of radium.

Infiltrating Non-ulcerating Lesions.—These are treated by radium packs and moulanges. The greatest distance compatible with duration of treatment and efficiency is 3 centimeters. There are those who would use the convenient and better distance of 4 mm, but with only 75 mg of the element the time is too long. For the sake of convenience, we use distances of 1 cm, 2 cm, and 2.5 cm, or one inch. All areas are blocked out in carboltuchsin or ink in 2.5 cm squares. All corks for treatment are cut 2.5 cm square.

The erythema time at 1 cm with 1 mm brass filter, 2.5 X 2.5 cm area, is 294 mg -el -hours. We give 600 to 800 mg -el -hrs in one week.

Upon increasing the distance to 2 cm, we increase the time to 350 mg -el -hrs, whereas at 2.5 cm, 500 mg -el -hrs can be given.

Moulanges may be made of Columbia paste or dental compound. Regaud believes Columbia paste produces secondary radiation which is advantageous. Columbia paste can be made in any laboratory, is inexpensive, and is very easily handled. For irregular or inaccessible lesions this is an ideal



Fig 5 Parotid tumor before radiation



Fig 6 Lesion mapped for radium therapy



Fig 7 Radiation response. Erythema three weeks after the last radium application

method of treatment. At the Radium Institute in Paris the smaller moultages are saved, and the location of the radium tubes indicated by thick wire. Should the patient develop a recurrence, its location is compared with the moulage so that the defect in treatment may be corrected in subsequent cases. The paste is warmed in hot water until soft, gently applied to the surface or lesion. Cold water is used immediately upon its removal to chill it so that it retains the shape of the lesion. Distance can be secured by planting the tubes on the exterior of the moulage in grooves made by a hot wire.

COMBINED RADIUM AND X-RADIATION

The use of two types of radiation over the same skin area is not new, but is productive of excellent results and deserves wider use than it now enjoys. Rather than go into an elaborate discussion of theory and methods we will report the treatment as actually given in a case of parotid tumor.

The parotid tumor, which measured 4 cm in diameter, was raised 2.5 cm from the normal facial contour (Fig 5), covered with distended venules, slightly reddened, hot to the touch, and firmly fixed to the deep structures, but not to the skin. There was no lymphadenopathy, and the routine laboratory examinations were negative.

The X-ray treatment was given first—eight treatments in a period of sixteen days—rising by 30 per cent doses to 90 per cent, maintaining this figure plus or minus 5 per cent for the period. The total radiation was 335 mma, 140 K V, 5 ma, 4 mm Al filter, at a skin-target distance of 40 centimeters. The area covered the cheek, adjacent neck, and ear.

With the before-mentioned factors the erythema time was 175 mma—the machine has been calibrated by J. L. Weatherwax. The 335 mma dose is 191 per cent of an erythema dose.

A fortnight later, radium therapy was instituted. At this time a small sinus had opened in the center of the tumor mass, but no pus or secretion discharged. It presented the typical appearance of malignant ulceration with rolled edges.

Ten areas (Fig 6), each measuring 2.5 sq cm, were laid out over the neoplastic area. A square cork, 2.5 cm on each side, was cut 1 cm thick and to the superficial side of this the two brass capsules of 50 and 25 mg, respectively, were strapped. Wall thickness 1 mm brass. Each area was numbered and treated in rotation for three hours, i.e., 225 mg-el-hours.

On the eighteenth day after the radium treatment, the patient had a severe erythema with desquamation, but no blistering. The sinus was closing and the pain relieved (Fig 8). On the thirty-second day the erythema had diminished, evidencing a tendency to browning and early desquamation. The center of the tumor was shrunken and sclerotic, the periphery was a hard fibrous mass one-third the previous size.

Quimby (8) reports on the theoretic aspect of combined radiation, Widmann on the clinical application of two types of radiation. It is beyond the scope of this paper to discuss the theory—suffice to say the results are far superior to one type of radiation in selected cases.

SUMMARY

Small quantities of radium may be used to great advantage by an experienced, well-trained, and ingenious radiologist.

A detailed review of methods now in use in this laboratory is given, omitting statistics and striving for simplicity and clarity.

The apparent simplicity of these methods should not becloud the fact that a great deal of wisdom, tact, and experience are necessary in their use, and that the tyro will fail if he attempts it.

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TWO UNUSUAL CASES REVEALED IN ROUTINE ROENTGENOGRAPHY¹

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OCCASIONALLY in the smaller communities an odd case is accidentally disclosed during the process of a roentgen examination

In the cases considered at this time, the first is a regular routine examination of the nasal accessory sinuses in a boy, nine years of age, which showed, in addition to the sinus and nasal pathology, a striking fold of increased density intracranially in the left parietal area. The second was an X-ray examination for a suspected fracture of the left clavicle in an infant, nine months of age, which showed no evidence of a fracture, but a suspicious shadow in the left thorax resembling the gastric saccule, without a definite shadow of the cupola of the left diaphragm.

Case 1 H A., aged 9 years Height, 4 feet 2 inches Weight, 66 pounds Pulse, 80 Temperature, 98.6 Blood pressure 114/76 The boy, of well nourished and healthy appearance, was of the phlegmatic type. His father, whose health previously had been good, had died at 26 years of age of sinus thrombosis following an infected third molar. The mother, aged 32 years, was living and well.

Personal History—Malnutrition in infancy, scarlet fever, whooping cough, mumps, chicken pox, pneumonia. There was no syphilitic history and the Wassermann test was negative.

There was no history of injury at birth. During infancy there was a period of malnutrition at six months, with some convulsive attacks. At that time there was a noticeable increase in the size of the cranium, but no definite history of a true hydrocephalus or meningitis is obtainable. There is an indefinite history of a scalp laceration in the frontal region at six years caused by a falling object. The boy's health had been apparently good, with the exception of the usual diseases of childhood, as enumerated above, until two years previous to examination, when the headaches began. They were accompanied by a sense of pressure in the left parietal region and frequent attacks of epistaxis. The mother noticed a seeming retardation of the mental development also.

Roentgen Findings—On Aug 25, 1930, the first roentgen examination was made, following complaint of nasal accessory sinus pathology causing chronic headaches, epistaxis and occluded nasal passage on the left side, and lethargy. The films of the first examination are not available, but at that time there was a definite increase in density involving the right antrum, marked deviation of the nasal septum to the left, with occlusion of the left nasal passage and poorly defined anterior ethmoid cells. In addition, there was a striking fold of increased density apparent in the left parietal area, intracranially, which was obviously abnormal and stimulated interest on account of the headaches and sense of pressure in this region.

A second roentgen examination was made Sept 9, 1930. The same sinus and nasal pathology was demonstrable, and in the different views of the skull the increased density noted was more apparent and better demonstrated. There was a definite increase in the size of the calvarium in relation to the face and mandible. In the postero-anterior view, taken at 107 degrees, the widest horizontal diameter was 19.7 centimeters. The fold of increased density on the inner

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles, Dec 1-5 1930



Figs 1 and 2 Postero-anterior views of the skull in Case 1, showing increase in the size of the calvarium and fold of increased density on the inner surface of the cranium (See text.)

surface of the cranium in the left parietal area extended from 2 cm left of the sagittal suture to the left mastoid area, being about 13 cm at the thickest part. The tables showed no definite bony production or destruction and the fold was not of the density of calcium, it was apparently a soft-tissue shadow. The antero-posterior view of the occipital area showed this density more distinctly, and here it measured 18 cm at the thickest part. The lambdoidal sutures and the inner table of the skull were well defined and apparently intact in this view. The fold was accentuated by a channel of decreased density which seemed to communicate with the middle meningeal groove, especially in the postero-anterior views, in which the longitudinal sinus was visible and apparently dilated.

In the left lateral view of the skull, the occipito-frontal diameter was 20.1 centimeters. The inner table was well defined and there was a triangular area of increased density at the vertex, just posterior to the bregma, with the base at the groove for the middle meningeal vessels and the apex touching the inner table in the left parietal area about 5 cm posteriorly. It was 2 cm wide at the base. The groove for the middle meningeal vessels was very definite and apparently widened, at least more so than usual, and it seemed to invade the inner table at the vertex. This increased density and the wide meningeal groove were not apparent in the right lateral view of the skull. (This film, as well as the films of the first examination, was lost when the case was referred.)

These findings show definite evidence of a pathologic lesion intracranially, suggestive of a thickened fold of dura mater coincident with a probable aneurysm involving the middle meningeal vessels, and dilatation of the longitudinal sinus demonstrable at this examination.

Operative Findings—This case was referred to Dr Cecil Reynolds, of Hollywood, for diagnosis and treatment. After finding neurologic evidence of intracranial pressure in the area noted, the pre-operative diagnosis was an old, organized, extra-dural hemorrhage. The operation consisted of the fashioning and turning downward of a left parietal osteoplastic flap. Very severe bleeding from a large vessel passing to the bone from a dilated lacunal varix was encountered, also from a slight tear in the large ascending abnormal dural vein, running directly up to the varix. Muscle grafts were placed on each of these bleeding points as the brain pressure, which was at first markedly excessive, gradually diminished. Cotton pads had to be placed over the grafts to hold them *in situ*, and the flap temporarily replaced with silkworm-gut. The enlarged dural vein was tied in two places below the varix.

Post-operative Diagnosis—Diagnosis was of a varix connected with the longitudinal sinus, secondary to an internal hydrocephalus. The following day the flap was turned downwards, the cotton pads soaked off with saline, and the grafts pressed on firmly. The flap was replaced, after all the blood was cleansed, with two cigarette drains (Penrose) projecting through each drill hole to drain the surface of the dura. The dura was never opened. The thickened dura was thought to be the result of an early inflammation of the meninges.

Differential Diagnosis—The lesions most commonly found affecting the external surface of the brain are the arterio-venous and venous malformations, as stated by Cushing.

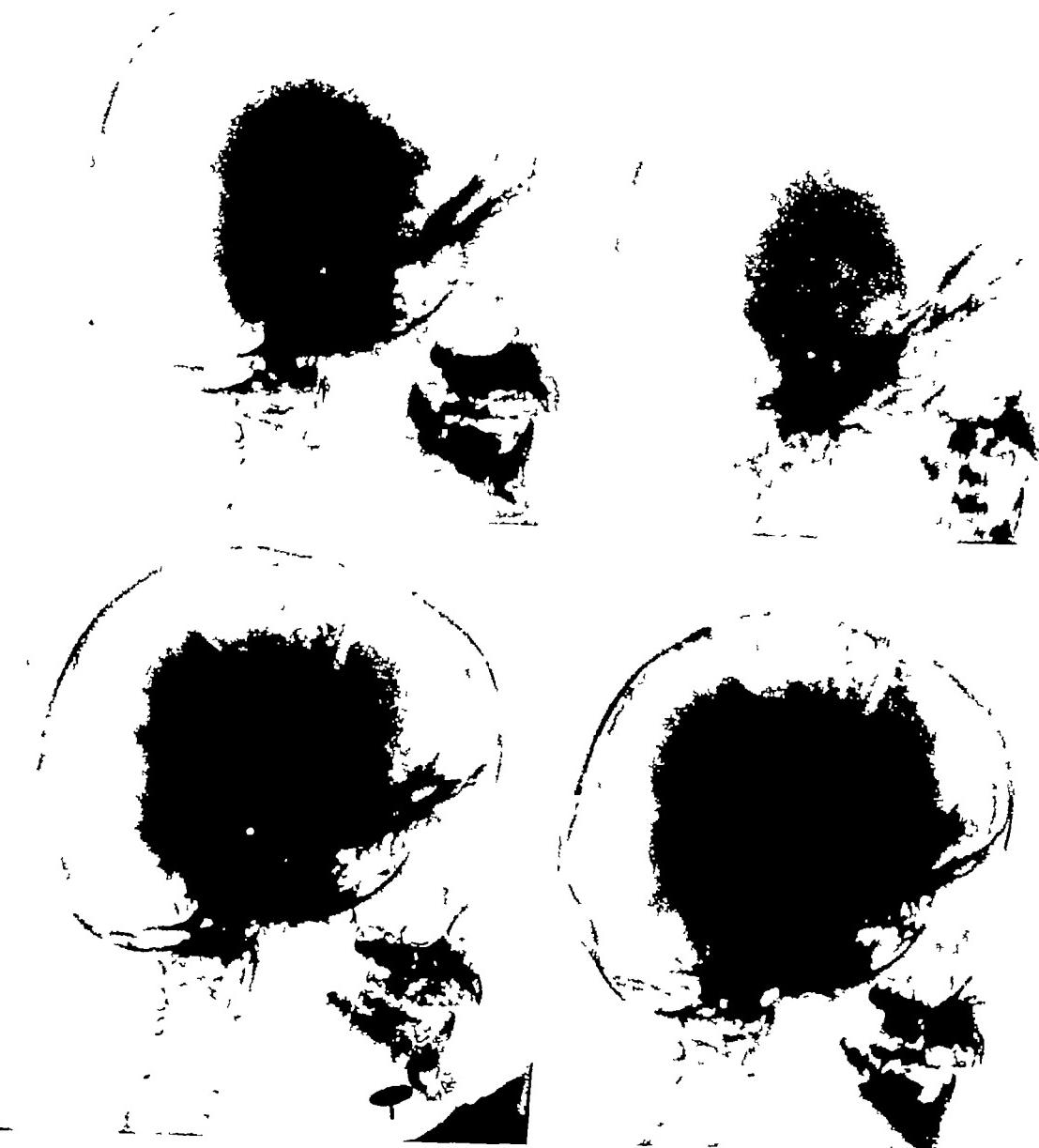


Fig 3 Case 1 The dense fold here measures 18 cm at its thickest part

and Bailey, which are primarily surface lesions of the hemispheres. Types may be recognized as simple enlargement of a single vessel, one or more vessels, or complicated racemose types. The lesion extends from the cerebral surface, like an inverted cone with the apex abutting a ventricle, into which a terminal hemorrhage sometimes occurs (3).

Meningiomas or endotheliomas, formerly believed to originate from the dural surface, are now believed to originate from the arachnoid and to comprise about 12 per cent of intracranial tumors. There is usually irregular bone proliferation from the lesion extending and squeezing into the crevices and bone spaces, irritating the bone. Erosion, vascularity, bone changes, spicule formation, diffuse thickening, enlargement of the meningeal channels, and calcification are the results of these lesions (20).

Syphilis with headache, the commonest symptom, usually shows marked osteoperiostitis, circumscribed, multiple, or single, in



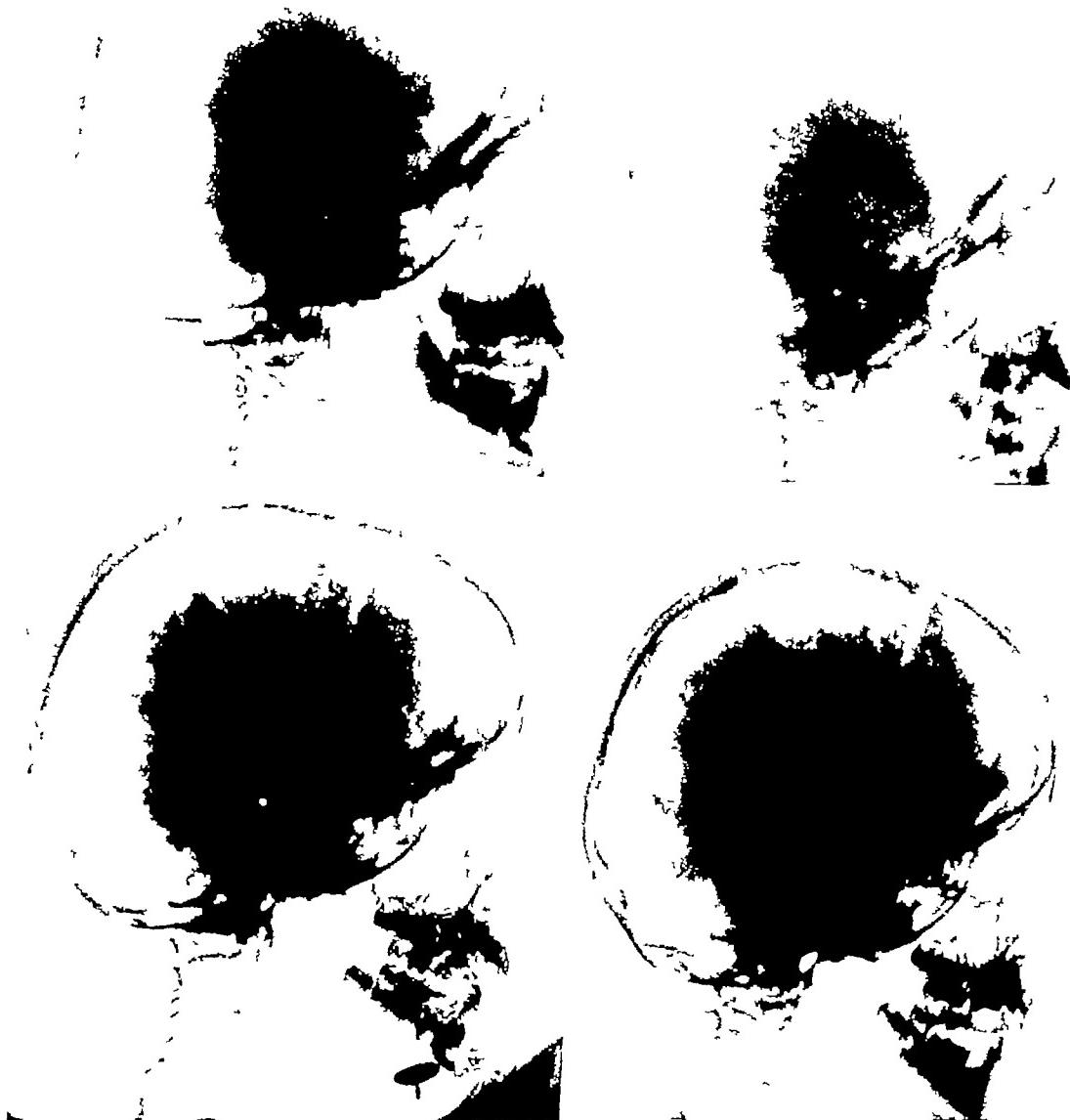
Figs 4, 5, 6, and 7 Lateral views of the skull in Case 1, showing the area of increased density at the vertex and the groove for the middle meningeal vessels definitely widened (See text.)

the cranial dome. The transparencies of gummas are usually round or oval.

Tumors of the soft tissues of the skull—angiomas, fibromas, dermoid cysts, and lipomas—may produce deformities of the skull, but they rarely produce new bone. They usually cause bone atrophy from pressure,

while malignant growths may infiltrate the bone or cause pressure atrophy.

Injuries of the skull and its contents form hematomas and aneurysms due to arterial injury, and cause atrophy from pressure. Concussions, contusions, or laceration of the brain, membranes, or vessels from



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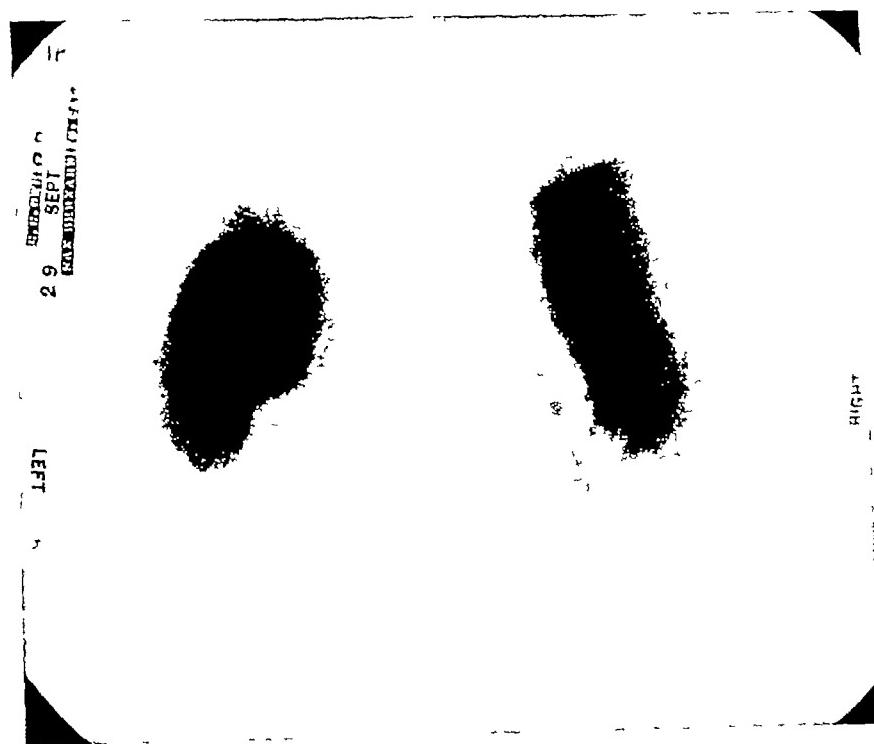
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Fig. 13 Right and left lateral views in num, and left lung displaced to the right



apparently elevated, but did not seem to move with respiration. The movements of the right diaphragm were very definite as while the right dome was at the level of the tenth rib A postero-anterior view taken at the end of fifteen minutes showed the esophagus



Figs 10 and 11 Postero-anterior views in Case 2, showing elevation and fixation of left diaphragm with resultant high position of the stomach and splenic flexure.

Case 2 F S., an infant aged nine months, was well nourished and normal in appearance. He was examined Sept 28, 1930, for a suspected fracture of the left clavicle following a fall from a high chair two days previously. The parents had noticed a limitation of movement of the left shoulder, and the child cried when it was moved. There was no definite evidence of a fracture demonstrable, but there was a

suspicious shadow in the left thorax resembling the gastric saccule, the splenic flexure was high, and the dome of the left diaphragm was not easily demonstrable. The heart, mediastinum, and left lung were displaced considerably toward the right. Physical examination showed some dullness in the left thorax, and there was a depression in the left costochondral margin which was apparently congenital. The apex beat was in the midline. There was no history of trauma except the recent fall from a chair. There had been gastro-intestinal symptoms of colic, and feeding difficulties, with regurgitation at times, which had been corrected by proper feeding formulae.

The following day, the child was immobilized by being wrapped in a sheet, one ounce of barium sulphate was added to the regular bottle feeding at ten o'clock, and administered under fluoroscopic observation.

Roentgen Findings—The barium mixture filled the esophagus, which descended as a straight column normally, slightly to the right of the vertebral shadow, to a point opposite the eleventh dorsal vertebra, where it entered the stomach. The fundus was apparently at the level of the third rib anteriorly on the left side, above this there was an unbroken curved arch of increased density identified as the diaphragm. It was



Fig 12 Another postero-anterior view of the thorax, Case 2

the diaphragm, while an angulation above the gas rises to the upper limit of the hernia. Pneumoperitoneum will outline the left inferiorly, but with hernia and not hernia. Probably evagination is not disturbed—is since the continuity dome, sharply defined—since the continuity is not disturbed—since the continuity is normal, but that a smooth rounded hemicommision, even traction and diaphragmatic hernia remains traction due to pressure from below or traction above is usually temporary and not traction who says that, notwithstanding the X-ray, true evagination is according to Stoof (19), Ritso (15) states that congenital weak-

If the hernia is limited and the sac visible, traction the relaxed atroposed diaphragm lower boundary of the lung, and in even- congentital absence the herniated viscera and the sac in true hernia, in false hernia and tonic, and clinical manifestations of the hernia may have identical pathologic, ana- hernia may have identical pathologic, ana- diagnostie value, and that evagination and incents of that pneumoperitoneum has any Ritscoom (16) denies the paradoxie move-

the diagnosis may be made

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the diaphragm is usually angulated at the orifice

Barium shows the esophagus rarely tor- sion, which disappears with reduction. It while evagination shows an elevation of the diaphragm with resumption high stomach, while probable determining factor in hernia, less of the musculature of the diaphragm is more cases are being disclosed.

Rare, although since the use of the X-ray is rare, although since the use of the X-ray incidents are reversed and that true evagination movements Moore (14) says that the move- phrenic nerve also presents paradoxie move- the movements paradoxie Paralysis of the while in hernia the outline is obscured and more elements are limited although normal, Holmes and Riggle (6) state that the movements and Riggle (6) state that the is also a difference in opinion regarding the hernia. Evagination is regarded etiology, calli as congenital and is irreparable. There recentgen finding rather indicates entra- phases of the same trouble (8). A constant sidered by some authorities to be different paroxysms from the physiologic, and are often difficult to determine. Both are de- phragmatic hernia, because the difference is iated position of the diaphragm and dia- different between evagination or ele- Voluntuous literature has arisen on the condition

phragm are necessary, as this is an operable barium and a distinct outline of the dia- through it. Identification of the hernia with either side. Escape of a portion of the stomach with an escape is weakened or relaxed, esophageal orifice is strengthened or relaxed (5). Acquired hernia may result if the mal contents to escape into the thorax on (congenital hernia) may allow the abdominal net (6).

True evagination is irreparable and perma- shows a broken line and some angulation

(4) A defect in the diaphragm at birth net (6).

(5) Acquired hernia may result if the mal contents to escape into the thorax on (congenital hernia) may allow the abdominal

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Fig. 16 Postero-anterior view, after 24 hours.

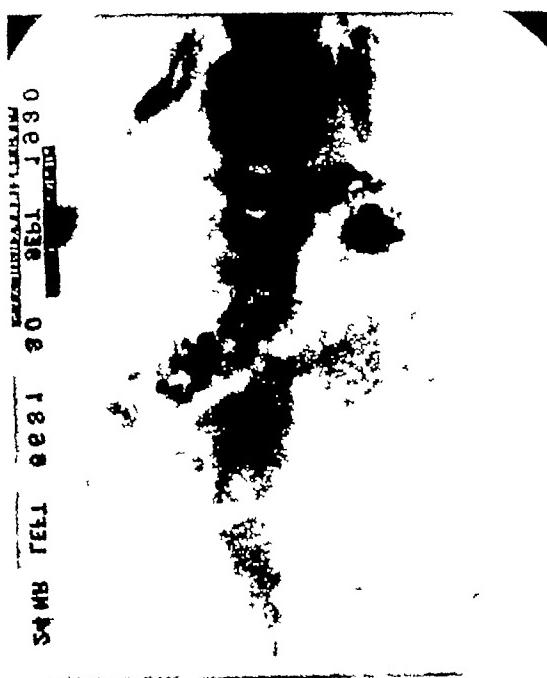




Fig. 14 Anteroposterior view, after 15 minutes
Case 2



Fig. 15 Postero-anterior view, after six hours,
Case 2

filled with gas and high in the thorax. The dome of the left diaphragm remained elevated in the thorax. There was a small resi-

due of barium in the descending colon near the sigmoid with the remainder in the distal colon and rectum

Differential Diagnosis.—According to Le Wald (11), certain congenital and acquired conditions of the diaphragm are classified as follows

- (1) Absence of left half of diaphragm
- (2) Thoracic stomach
- (3) Eventration of the diaphragm
- (4) Congenital hernia
- (5) Acquired hernia

(1) Absence of the left half of the diaphragm can be diagnosed by roentgen examination and roentgenograms, especially in the lateral view. A correct diagnosis of this condition is important, particularly in regard to the risk of surgical intervention, which is contra-indicated if the diaphragm is absent. A lateral view reveals the absence of a regularly curved or arched line of the diaphragmatic dome, which if present can be traced to its attachments.

(2) Thoracic stomach can be demonstrated by the roentgen examination and shows the stomach in the thorax with the diaphragm perfect in form below it and intact on both sides. No surgical intervention is necessary unless some gastro-intestinal complication occurs.

(3) Eventration of the diaphragm may occur on either side, but is usually on the left side. It may assume a high level and should always show an even curved outline, especially in the lateral view. Contrast opaque mixture is often necessary to differentiate the upper border of the stomach from the leaf of the diaphragm. It is usually due to atrophy of the musculature or secondary to phrenic nerve disease, and is sometimes very difficult to differentiate from diaphragmatic hernia with a sac, even with barium mixture or pneumoperitoneum—especially if the muscle fibers are exceedingly thinned out, or the sac presents an uneven curved line. However, a sac usually

shows a broken line and some angulation True eventration is irreparable and permanent (6)

(4) A defect in the diaphragm at birth (congenital hernia) may allow the abdominal contents to escape into the thorax on either side Identification of the diaphragm shadow is important, as hernia is operable

(5) Acquired hernia may result if the esophageal orifice is weakened or relaxed, with an escape of a portion of the stomach through it Identification of the hernia with barium and a distinct outline of the diaphragm are necessary, as this is an operable condition

Voluminous literature has arisen on the differentiation between eventration or elevated position of the diaphragm and diaphragmatic hernia, because the difference is often difficult to determine Both are departures from the physiologic, and are considered by some authorities to be different phases of the same trouble (8) A constant roentgen finding rather indicates eventration, while a variable condition suggests hernia Eventration is regarded etiologically as congenital and is irreparable There is also a difference in opinion regarding the movements of the elevated diaphragm Holmes and Ruggles (6) state that the movements are limited although normal, while in hernia the outline is obscured and the movements paradoxical Paralysis of the phrenic nerve also presents paradoxical movements Moore (14) says that the movements are reversed and that true eventration is rare, although since the use of the X-ray more cases are being discovered

Ritvo (15) states that congenital weakness of the musculature of the diaphragm is the probable determining factor in hernia, while eventration shows an elevation of the diaphragm with resultant high stomach, splenic flexure, and small intestine

Barium shows the esophagus rarely tortuous, which disappears with reduction It is usually angulated at the orifice

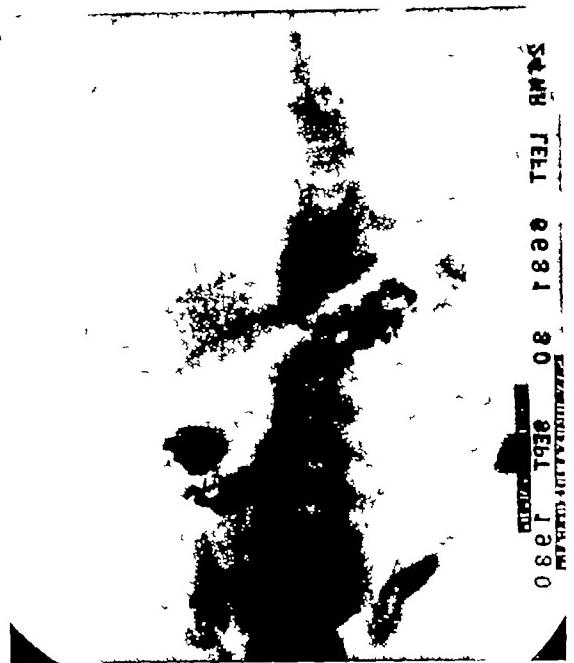


Fig 16 Postero-anterior view, after 24 hours, Case 2

Rusconi (16) denies the paradoxical movements or that pneumoperitoneum has any diagnostic value, and that eventration and hernia may have identical pathologic, anatomic, and clinical manifestations if the hernial ring is large The arched line may be the sac in true hernia, in false hernia and congenital absence the herniated viscous and lower boundary of the lung, and in eventration the relaxed atrophied diaphragm If the hernia is limited and the sac visible, the diagnosis may be made

Elevation due to pressure from below or traction above is usually temporary and not true eventration, according to Stoloff (19), who says that, notwithstanding the X-ray, eventration and diaphragmatic hernia remain uncommon, but that a smooth rounded dome, sharply defined—since the continuity is not disturbed—is probably eventration and not hernia Pneumoperitoneum will outline the leaf inferiorly, but with hernia the gas rises to the upper limit of the herniating mass, indicating absence or limit of the diaphragm, while an angulation above

the mass suggests herma. All the facts must be available, and even then a differentiation is sometimes impossible, according to Schonfeld (17), and errors are easily made (14).

Conclusion—In this case the esophagus was apparently straight and not tortuous or shortened, while there was an apparent congenital anomaly of the stomach and duodenum, with elevation and fixation of the left diaphragm and resultant high position of the stomach and splenic flexure in the thorax. The heart, mediastinum, and left lung were displaced toward the right side, and there was an unbroken distinct arched line of the elevated diaphragm demonstrable in both postero-anterior and lateral roentgenograms when the contrast mixture filled the stomach. These findings, in the absence of a history of definite early trauma or clinical symptoms, rather indicate the condition to be one of true congenital eventration of the diaphragm, and an anomaly of the stomach, not amenable to operation unless some complication arises.

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HEPATOSPLENOGRAPHY

ROENTGENOLOGIC DEMONSTRATION OF THE PARENCHYMA OF THE SPLEEN AND LIVER BY
MEANS OF A NEW INTRAVENOUS CONTRAST MEDIUM (THOROTRAST)

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Translated by H C OCHSNER, M D, INDIANAPOLIS, INDIANA

IT IS a great privilege to report herewith a new method by which the liver and spleen are made roentgenologically visible following intravenous administration of a colloidal contrast medium. The results obtained in a series of cases in which this method was used will be described.

The possibility of direct visualization of the liver shadow was suggested by the visualization of the gall bladder obtained by Einhorn (1), following administration of tetraiodophenolphthalein, and the use of toradol later suggested for hepatosplenography by Oka (2) and Radt (3). This new colloidal contrast medium is not precipitated by the organic fluids and has been used for retrograde pyelography. After experiments on animals controlled by anatomic studies made by Dr J Rossier (4) in the Pathologic Institute of Prof M Askanazy, a clinically applicable method was developed which makes possible the roentgen visualization of the liver and spleen without risk to the pa-

tient. The author (5) has used this method on patients in Prof M Roch's University Clinic for Internal Medicine.

Thorotrust is a 25 per cent thorium dioxide sol containing 22 per cent of metallic thorium. It has a bluish, milky, shimmering appearance in reflected light. In transmitted light it appears as a clear, brownish fluid. For intravenous use it is diluted at least ten times with 5 per cent glucose solution, sterilized by heating, and injected in increasing doses in the course of several days. To determine the patient's tolerance, an initial dose of not more than 0.1 gr of thorotrust per kilogram of body weight is given. After that, each dose is increased from 0.1 to 0.05 gr per kilogram of body weight until the desired dose is given, care being taken not to exceed the patient's tolerance. As a rule, a total of 0.8 gr of thorotrust per kilogram of body weight is enough to produce an intense shadow on the roentgen film, the density of the



Fig 1 Hepatosplenogram of a normal liver and somewhat hyperemic enlarged spleen. (Rays directed vertically, patient lying on abdomen.)



Fig 2 The same case radiograph of the abdomen before injection



Fig 3 Hepatosplenogram of an ectopic, vertically elongated liver and a normal spleen (Margins indefinite due to movement, patient in stupor)



Fig 4 The same case with patient on her back. Due to abnormal mobility, the liver has assumed a horizontal position under the diaphragm

liver being approximately equal to that of the vertebrae, and the density of the spleen to that of the ribs (Figs 1 and 2). In

the event that visualization of the margins of the liver and spleen is all that is desired, one-half to one-third of the dose is sufficient.

Roentgen observation should be made 24 hours after the last injection, and a flat dorsoventral plate of the upper abdomen, taken with the patient in the supine position, is ordinarily sufficient. If the organs are abnormal in structure or position, special views are necessary, using a definite technic (6). The patient lies on the abdomen and the rays are directed dorsoventrally at an angle of from 20 to 30 degrees toward the patient's head, so that the liver is visualized in its greatest transverse and smallest vertical diameter. In the event that there is an appreciable variation from the normal position, the direction of the rays is correspondingly changed so as to be perpendicular to the plane of greatest diameter of the liver.

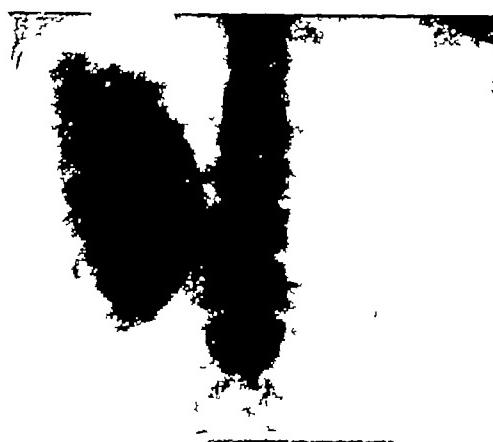


Fig 5 Hepatosplenogram in a large chronic permanent splenomegaly. There is absence of the spleen shadow. The somewhat enlarged dense liver shadow is displaced to the right and downward (dorsoventral view).



Fig 6 The same case hepatogram in oblique position

Fig 7 The same case before injection. The greatly enlarged spleen displaced downward, the barium-filled stomach and small bowel (Patient standing)

The technic of Rieder and Groedel is applicable to the spleen.

The intense shadows of the liver and spleen are due to the storage of the electrically negative colloidal particles of thorium in the reticulum cells in the pulp of the spleen and in the Kupffer cells of the liver (of which from four to five containing granules are visualized in every microscopic field of histologic specimens). Some of the colloidal particles are also demonstrable in the bone marrow, lungs, and adrenals, but the resultant increase in density is insufficient to render them visible in the roentgenogram. After a limited time interval, no anatomic changes could be demonstrated in the tissues of experimental animals.

The injections are generally well borne, and, aside from occasional transient dis-

turbances, no serious complications have occurred. In three cases there was vomiting, twice in patients with cirrhosis of the liver and once in a case of chronic nephritis. In a patient with a large chronic splenomegaly of unknown nature, there was a slight hemolytic shock following the last injection, which was readily relieved by an injection of adrenalin. A fit of coughing was produced in an asthmatic patient.

The hemoglobinuria occasionally observed in guinea pigs has not once been observed in 25 injections in humans and was evidently due to faulty technic in the experimental animals. Blood studies showed a slight, transient diminution in the erythrocyte count. Liver function and other clinical examinations were entirely negative. Although the method gives precise information about

the topography of the liver, it is particularly indicated in those diseases of the liver or spleen in which circumscribed pathologic-anatomic changes take place. In cases in which the normal tissue is displaced by a

shadow was obtained in a case of cirrhosis (8) in which the spleen was enlarged and cast a good shadow. The enlarged spleen was poorly visualized in a patient who had malaria (therapeutic), and there was a com-



Fig. 8 (left) Radiograph of the liver of an experimental animal injected with very large doses of thorotrust

Fig. 9 (right) Radiograph of the spleen of an experimental animal impregnated with a large dose of thorotrust

tumor mass, an echinococcus cyst, a circumscribed abscess, a syphilitic gumma, etc., the contrast medium is not absorbed, and a negative shadow is visualized on the roentgenogram, as Radt (7) demonstrated in two cases of cancer of the liver. As the various processes differ in their pathologic-anatomic picture, so also different and characteristic shadows are obtained. Care must be taken not to confuse gas in the intestine for intrahepatic negative shadows.

Disease processes which produce diffuse pathologic-anatomic changes in the liver and spleen seldom constitute an indication for the examination. For example, a poor liver

plete absence of the spleen shadow in a very large permanent splenomegaly of unknown etiology.

The contra-indications are those pathologic conditions in which the colloidal contrast substance cannot be taken up by the reticulum cells and might produce injury due to its prolonged period of circulation in the blood stream.

After the rapid administration of very large amounts (15 to 20 times that ordinarily used) of thorotrust intravenously, the author found in guinea pigs that the reticulum cells of the liver and spleen were unable to absorb all the colloidal contrast

medium so that many granules were not only absorbed by the reticulo-endothelial cells of other organs but by the endothelial cells of the glomeruli of the kidneys.

There was hyaline degeneration of many glomeruli, and the liver cells assumed a necrotic appearance. The method should therefore not be used in patients with severe hepatic or splenic insufficiency, especially those in whom there is also some renal damage.

The picture in specific diseases of the reticulo-endothelial apparatus, for instance Gaucher's disease or lymphogranulomatosis, is still unknown, and it will be necessary to exercise great caution in their investigation.

Thorotrust, the suspensoid which is used, is not toxic. Like other thorium-containing colloidal contrast media, it is not attacked by acids or alkalies even in high concentration. Bluhbaum, Frick, and Kalkbrenner (9) injected thorium hydroxide sol subcutaneously in animals, and six months later were unable to demonstrate histologically any cell changes. The author's animal experiments similarly show that thorotrust produces no injurious effects unless it is given rapidly in large doses. With very large doses, the author and J. Rossier obtained osteomyelograms (Fig. 10) and nephrograms (Fig. 11).

Several months after injection of thorotrust, animals were found to be normal, two guinea pigs, one of which received massive doses, bore normally developed living young. Weight loss occurred only in animals which had received a much larger quantity of thorotrust than is necessary for hepatosplenography.

The excretion of thorotrust is very slow and the liver and spleen shadows produced by the contained thorium persist for a long time. Only after a period of several months is there an appreciable diminution of the shadow density. Probably a portion of the thorium is excreted through the lungs, since



Fig. 10 Experimental osteomyelogram in a guinea pig. Lateral view of the leg.

granules in appreciable numbers are always found in the endothelial cells of the pulmonary alveoli. The extent to which the liver and kidneys take part in the excretion is not entirely known.

The radio-activity of thorium is apparently too slight to produce any harmful effects in the comparatively short time it remains in the organism. In the Radium Institute of the Academy of Freiburg, umbrathor was investigated for its radio-activity. The thorium dioxide content of this substance is equal to that of thorotrust. One hundred cc of this colloidal sol contains a quantity of radio-active substance, the gamma-ray equivalent of which is that of the gamma rays of 1.24×10^{-6} gr of radium. Since only 40 gr of thorotrust

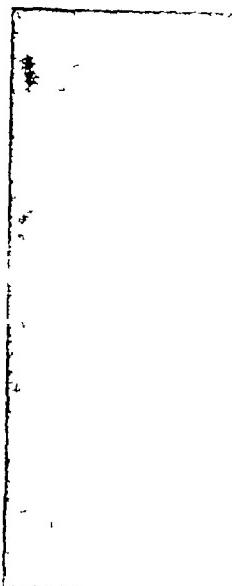


Fig 11 Experimental nephrogram in a guinea pig

are required to produce good visualization of the liver and spleen in a 50-kilogram individual, the total gamma-ray equivalent is that of the gamma rays of 0.496×10^{-6} gr of radium

Thorotrast is a preparation of non-toxic nature which, in contrast to umbrathor and tordiol, is unchanged by the action of the body fluids, as Weiser (10) has demonstrated. J. Rossier and the author have shown in animal experiments that it can be introduced into the blood stream without the production of capillary emboli. It should, therefore, achieve a sphere of usefulness not only in the limited field of medical roentgenology, but also in other branches of clinical medicine. It is more readily tolerated than the colloidal metals which have heretofore been used in medicine for non-specific therapy. Small doses could be used in the treatment of various acute or chronic diseases such as syphilis or tuberculosis.

Another phase that should be investigated is the sensitization of the cells to radiation therapy in the presence of tumors. The author noted a striking therapeutic effect in some of the patients he examined whose

reticulo-endothelial apparatus was apparently normal. Two patients whose condition before injection was so poor that they were regarded as hopelessly incurable were greatly improved in a relatively short time.

CONCLUSION

It may be said that the above described method of hepatosplenography has given entirely satisfactory results from the roentgenologic, clinical, and anatomic standpoints, and has appeared harmless over a limited time. In many instances it was apparently of therapeutic value. Until it has been used in a larger series of cases and these have been observed for a longer period of time, it should not be used routinely, especially in young individuals. The indications at present are limited to cases of carcinoma, echinococcus cysts, and abscess of the liver and spleen, especially those in which there is a likelihood of subsequent surgical interference.

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New Super X-ray Tube Equal of World's Total Radium—All the radium in the world could not make more intense rays for the treatment of cancer than the new 900,000-volt, cascade X-ray tube of the New York Memorial Hospital, Dr G Failla recently told his fellow-physicists at the meeting of the American Physical Society.

One and one-half inches of lead are easily pierced by the rays from the new tube, which was developed by Dr W D Coolidge

Danger to workers with this tube, run for

several hours a day, is considerable, said Dr Failla, in describing the protective means employed in the laboratory

Running at 700,000 volts and five milliamperes, the radiation from the tube is equivalent to the rays from 600 grams of radium, the total amount isolated pure in the world. Some eight grams of this—more than anywhere else in the world—is located at the Memorial Hospital itself.

New methods of treating cancer victims were sought in these experiments, comparing the new X-rays with radium rays.

THE VIENNA RADIOLOGICAL SOCIETY

SESSION, MAY 5, 1931

Translation by HENRY RIGGS WOLCOTT, CHICAGO

Chairman, Professor Kienbock, *Secretary*, Dozent Fleischner Professor Kienbock and Professor Schwarz expressed their thanks for having been chosen as chairmen of the Society

THE TECHNIC OF IRRADIATION OF THE TONSILS

DR G SCHWARZ The subject of the technic of tonsillar irradiation has been brought again to the forefront of interest by several German publications containing comprehensive statistics Several hundred cases with good results in from 80 to 90 per cent are reported In 1911, Menzel, in addressing the Vienna Laryngologic Society, was the first to announce good results from roentgen irradiation in chronic tonsillitis Through improvements in the technic it has become possible, in recent years, to improve the method Going back to my last presentation of patients before the Gesellschaft der Aerzte, I wish to give some further details in regard to the technic A correct technic is very important Failures and good results tardily secured are due to unsuitable technic but are adduced to discountenance the method

First, as to the shielding of certain parts After various experiments, I have found that the simplest plan is to cut from the center of a protecting plate 18 by 24 cm in size, an opening 5 by 7 cm or 6 by 8 centimeters This shield is applied in such a manner that the posterior margin of the submaxillary branch is barely covered (parotid gland), also the mandibular nerve and the larynx are protected The patient assumes the supine position with the shoulders raised somewhat The head hangs

loosely and is turned to one side Before the shield is applied, it is washed each time with concentrated alcohol A field back of the mastoid process remains unprotected The roentgen tube is so inclined that the central beam passes between the posterior margin of the lower jaw and the mastoid process of the side to be irradiated, and is directed toward the zygomatic process of the temporal bone on the opposite side If one desires to include adenoid growths, the beam is directed a little higher toward the orbit of the opposite side In the case of adenoids in children, the beam should be applied also to two fields reached from the back of the neck, with the patient in the prone position This technic corresponds essentially to that employed by Holfelder and Lenk

As to the dosage and the intervals between sittings, let it be stated that the single dose should be 3 H with a 0.2 zinc filter and 180 kilovolts If the patients do not live [near], one can irradiate both sides once on three successive days, and the patient can then be allowed to return home If the patients [do] reside [nearby], it is advisable to apply two irradiations each week, each side being irradiated three times The single dose may in the latter event be increased to 4 H If six weeks after the completion of the series of irradiations no evident effects are to be noted, another like series of irradiations should be applied A third series of irradiations after a further interval of six weeks is likewise admissible

It is advisable to furnish the patients with a statement covering the following points

1 The retrogression of the enlarged tonsils begins usually after from four to six weeks and proceeds gradually

2 During the first six weeks after the

irradiation, new attacks of sore throat may still occur

3 Even in the cases in which the tonsils do not diminish much in size, the predisposition to attacks of sore throat is usually eliminated within a few months

4 In about one-fifth of the cases the outcome of the irradiation is not a complete success, although some improvement can be expected in nearly every instance

It should be stated that in children the retrogression appears to be more rapid than in adults. It is important that the roentgenologist be acquainted with these details. Medical radiology has here a mission to perform, for it is important (especially in those cases in which surgical intervention is contra-indicated) that a form of treatment should be available that eliminates sore throat and its effects, particularly since the lingual tonsils and scattered tonsillar tissue about the pharyngeal ring can be influenced, whereas it cannot be removed by a surgical operation. Every radiologist must thoroughly understand the technic and must also study diligently the scientific aspects of the problem, since opposition from various sources is to be anticipated

DISCUSSION

With regard to the history of roentgen treatment of tonsillitis, K M Menzel stated that, taking as his point of departure the fact of the resorbent action of roentgen rays on lymphatic tissue, he began, as early as 1909, the systematic treatment of chronic tonsillitis by roentgen irradiation of the tonsils. A patient so treated was presented by [him] at the session of the Vienna Laryngologic Society, Dec 6, 1911. The patient was a man aged 30, who complained of frequently recurring sore throat, thick speech, snoring, and dyspnea. Examination had revealed greatly enlarged tonsils, which were in a condition of chronic inflammation

The speaker asked Prof Gottwald Schwarz, who was at that time the roentgenologic specialist for the sick benefit association, to undertake the roentgen irradiation of the patient's tonsils. At first the speaker planned to carry out the treatment by way of the mouth, and for that purpose had cylindrical metal tubes constructed which enabled the operator to confine the beam of rays to the tonsils and to shield the adjacent parts from the action of the roentgen rays. The patient was irradiated about ten times at intervals of fourteen days, the tubes just mentioned being employed. During this period of treatment, no striking effects of the intervention were observable. Not until Dr J Robinson undertook an irradiation of the tonsils from without, through the tissues overlying the two submaxillary angles, was an extensive shrinking of the tonsils brought about in September, 1910, with the result that the tonsils then presented approximately the size that the age of the patient would lead one to expect. A comparison of the condition of the tonsils before and after treatment showed a *reduction* in size equivalent to about three-fourths of the original volume. There are two things important to note: (1) That the tonsils, from the time the treatment was completed up to the time the case was presented, a period of more than one year, had not increased in size, and (2) that the formerly frequent attacks of sore throat had ceased since the beginning of treatment, a period of more than two years. Menzel closed his account with the statement that the method he had described appeared to be suitable for the elimination of not only tonsillar hypertrophy but also of the frequent recurrences of sore throat and peritonsillar abscesses that go hand in hand with chronic tonsillitis—especially in such patients as have an inordinate dread of operations or for whom tonsillectomy is contra-indicated because of the likelihood of severe

hemorrhages (hemophilia) or because of advanced age Menzel had, later, several other patients with tonsillitis or with adenoid growths irradiated by Dr Robinson. Although the results were reasonably satisfactory and the speaker still kept the subject in mind, there were three reasons why he could not continue to devote himself so intensively to the method (1) Because the treatment, as shown by the experiences at that time, covered too long a period (about nine months), (2) because the results could not be judged with absolute certainty in view of the fact that, even in severe tonsillitis and frequent recurrences of inflammatory conditions, remissions extending over several years are observed, and (3) because, at that time, owing to the exaggerated trend toward tonsillectomy, the result of American influence, the radical operation on the tonsils was universally demanded.

The speaker considers the irradiation method for the treatment of tonsils as still applicable and capable of giving good results, and he welcomes the endeavors of Schwarz and Kriser, with whom he will be glad to co-operate, more especially as many of the disadvantages of earlier days no longer exist, for example, the duration of treatment has become much shorter, the results can be measured with some degree of certainty, and we are not all of us to-day so enthusiastic about tonsillectomy. Hence, the speaker thinks he is safe in assuming that the treatment of chronic tonsillitis and of tonsillar hypertrophy with roentgen rays has a favorable future.

DR R KIENBOCK The new procedure will without doubt gradually replace operative treatment, because it offers not only greater advantages but also promises permanent results.

THE VARIOUS CAUSES OF DRYNESS IN THE MOUTH

DR J BORAK If after the irradiation

of both sides of the face the sense of dryness arises in the buccal cavity, it would appear, from our physiologic conceptions, practically certain that it is due to the diminished secretion of saliva resulting from the reduction of the activity of the salivary glands brought about by the irradiation. It is unquestionably true that the roentgen rays may reduce the functioning of the salivary glands, but there are a number of observations that seem to indicate that the sense of dryness arising after irradiations is not caused in every case by diminished secretion of saliva.

First, it will be recalled that the feeling of dryness in the mouth arises in connection with various local disorders of the buccal cavity and the pharynx and associated with various general conditions, although there is absolutely no evidence of a reduced secretion of saliva in these affections.

If the buccal cavity lies within range of the rays, it is surprising that at times when the patient complains of a marked sense of dryness, which can be relieved only by the ingestion of large quantities of fluids, an objective inspection reveals that the buccal cavity is moist throughout, in fact, one sometimes even observes considerable saliva in the form of the well known long-drawn-out threads.

This discrepancy between the subjective sensation and the objective findings becomes still more striking when we are confronted with the task of reducing in an objectively demonstrable manner the secretion of saliva. Such actual problems arise, as is well known, in fistulas of the salivary ducts, in which the activity of a normal salivary gland must be entirely suppressed, furthermore, in certain sequels of nervous and cerebral disorders (for example, in Parkinson's syndrome), in which the increased activity of both salivary glands must be reduced to normal. When we have such cases to treat, we observe that doses which suffice for the pro-

duction of the sensation of dryness are by no means sufficient for an objectively demonstrable reduction of the activity of the salivary glands. As in the treatment of hyperhidrosis, the irradiations in the latter case must often be applied with a very high dosage. Moreover, in the treatment of hyperhidrosis we do not see why the patient should complain of dryness when the hands are objectively still moist.

With reference to the treatment for increased salivation, we have another instructive observation to report. One or two days after the irradiation, there develops a sense of dryness, which lasts about a week, but not until the sensation of dryness has entirely disappeared is an objectively demonstrable diminution of the secretion of saliva in evidence. This not only begins later but also continues longer than the sensation of dryness.

From all these observations one is forced to conclude that the sensation of dryness in the mouth is brought about not indirectly through the reduction of the activity of the parotid gland but, rather, through a direct influence of the roentgen rays on the mucosa of the buccal cavity. It is well known that there are in the mucosa many branches of terminal nerves. The sensation of dryness following the irradiation of the buccal cavity is doubtless due to changes in these receptive sensory terminals. Further support for this view is furnished by the observation that I had the opportunity to make last year, since we have been using the Coutard method for the treatment of tumors of the buccal cavity. During the series of irradiations, there develops in the patients, in absolutely every case, a considerable disturbance of the sense of taste, so that the patients, for about two weeks, are unable to distinguish between sweet and salted foods.

A disturbance of the sense of taste occurs when each half of the face has received about 1,000 r, whereas a sense of dryness arises after doses of 350 r for each half of

the face. Since smaller doses are used for the treatment of chronic tonsillitis, a modification of the salivary glands and also changes in the sensory nerves of the buccal mucosa can always be avoided.

DISCUSSION

DR KARL EISINGER I take the liberty of asking Prof Schwarz to tell us at this point something about the indications and the contra-indications of the method. It is quite possible that a patient who already has an appointment during the next few days for a tonsillectomy will ask us, if this mode of treatment becomes generally known, whether he is to be operated on or whether his case is of such a character that roentgen irradiation appears indicated.

DR G SCHWARZ (closing) I wish to endorse absolutely Menzel's statements, since at the time of which he speaks, which was before we had the potent, penetrating rays, the high-power energies, and the good filtration, we had to proceed very cautiously and hesitatingly, for which reason the treatment was unduly prolonged. It is quite comprehensible that the laryngologist at that time made use of the irradiation procedure only in rare cases. With reference to Eisinger's request to state the contra-indications (which I wanted to avoid, at the present time), I am now forced to speak, and will say at the start that Schonfeld and Baumbach, of the Leipzig Children's Clinic (Prof Bessau), reject tonsillectomy in children absolutely, and approve, at the most, tonsil-lotomy, that is, clipping of the tonsils. They now accept irradiation as the procedure of choice. As contra-indications Schulte mentions advanced age (above 50 years), severe infection of the tonsils when there is danger of spreading the infection, involvement of the adjacent lymphatic glands, also disturbances of the endocrine system and of the heart, nephritis, diabetes, exophthalmic.

goiter, tuberculosis, asthma, hemophilia, or general physical weakness, furthermore in speakers and singers, and, finally, recurrences after previous tonsillectomy

THE SIGNIFICANCE OF THE MINUTE-R-AFFLUX FOR THE REACTION FROM IRRADIATIONS

DR R PAPE We are familiar with a number of observations which prove that the effect of a roentgen irradiation of given dosage depends on the duration of the irradiation and the intensity of the rayage. Back in 1924, G Schwarz observed distinct differences in the roentgen reaction on the skin, with changes in the intensity of the irradiation, which he represented by a relation of 1:4. On the other hand, a number of observations with a negative result have been reported, Borak's report having been one of the most recent. This apparent discrepancy may be explained by failure to consider the significance of the minute-r-afflux, which constitutes an expression of the absolute value of the rate of the irradiation. As these matters do not appear to be generally understood as yet, it may be well to cite four recent cases which show to how great an extent the skin tolerance, with a given dosage, depends on the intensity of the irradiation.

Conditions of the Experiment—Two abdominal fields, 13 by 18 cm, 0.5 Zn + 1 Al, 180 kilovolts, 1.0 ma. (or 0.5 ma), HED 35 (or 50) cm, dosimeter, Mekapion. The left field received 2×700 r in 2×65 minutes interrupted by a 24-hour interval. That makes a total of 1,400 r in about two hours of irradiation, the minute-r-afflux 10.7 r. The right field received 2×700 r in 2×65 minutes, interrupted by a 24-hour interval, a total of 1,400 r in about six hours of irradiation, minute-r-afflux 4 r. The relation of the irradiation intensity was thus

1:3, or, more exactly 1:2.67. The patients for these and other experiments were secured from the gynecologic department of Prof Latzko, who kindly placed an experiment room in his department at our disposal.

By the following description of results it can be demonstrated unequivocally that, in perfect agreement, the reaction of the *left* (that is to say, of the *rapidly irradiated field*) is considerably more marked than that of the *right, slowly irradiated field*. The difference does not become plainly discernible until after the main reaction (the fifth to the tenth week). The left field (10.7 r per minute) presented always a dense, brown, for the most part uneven pigmentation, erythema in patches, moderate scaling, subjective itching, while the right field (4 r per minute) presented a very delicate pigmentation, with only traces of an erythema.

By further experiments it was demonstrated that, with an irradiation intensity of 10 r per minute and the introduction of a 24-hour interval, the dosage can be increased, under the foregoing conditions, to 1,600 r.

SUMMARY

The skin reaction depends to a great extent on the minute-r-afflux. With a relation of the irradiation times, and thus of the intensities, the differences in the reactions are, indeed, considerable.

The tentative practical deductions from the experiments are. With an irradiation intensity of 10 r per minute, we can give 1,400 r in one day in two equal partial doses with an interval of from three to six hours, without endangering the skin. By introducing an interval of 24 hours, even 1,600 r are well borne. With a further reduction of the irradiation intensity to a minute-r-afflux of 4 r, a further increase of the dosage is possible.

DISCUSSION

DR R KIENBOCK In the last case, the dark border of the reactive pigmentation field is to be explained by the fact that here the electric discharges of the edge of the shield struck the skin, irritated and sensitized it and induced an hyperemia

DR J BORAK Dr Pape evidently misunderstood me if he thinks that I deny absolutely the influence of the protraction of the irradiation period on the tolerance of the skin. In my analysis of the Coutard irradiation method, my observations led me merely to express the opinion that the fractioning of the dosage exerted a more marked influence on the accentuation of the tolerance of the skin than did the protraction of the irradiation. It has been found, namely, that it is possible to effect a remarkable accentuation of the dosage by merely fractioning it. Mischer and Chaoul reached identical results. To a certain extent, also, the experiments of Dr Pape confirm that the mere protraction of the irradiation period influences the skin tolerance only to a very slight degree. For, while it is true that his experiments show a distinct difference in the skin reaction in the field irradiated three times as long, yet the difference is not three times as great. In other words, it appears to me that, from the practical point of view, it is not advisable to irradiate three times as long if only such a slight difference results. The difference consists mainly in the degree of pigmentation, whereas the duration of the reaction is the same. That with a relation of the irradiation periods of 1:3 a difference in the degree of reaction becomes evident is due solely to the fact that the partial doses employed by Dr Pape were extremely high. That 700 r, with ordinary irradiation intensity, can be repeated on two successive days appears to be the most surprising result of Dr Pape's experiments. Such high partial doses are not employed in con-

nexion with the Coutard irradiation methods. With a daily dose of only 200 r, when the irradiation is applied in accordance with the Coutard method, no difference can be observed with a total dose of 2,400 r, even when the relation of the irradiation intensities is 1:4.

DR G SCHWARZ The measurements of Dr Pape, carefully carried out, are especially important because they show that, even on the basis of 10 r minute-afflux and 4 r minute-afflux, changes in the tolerance dosage may be very distinctly observed in favor of the slow irradiation, as Dr Pape very aptly has termed this mode of administration. By applying rays of weak intensity and by checking the r afflux, we get extremely close to the doses that have become known as tolerance doses for radium irradiation at a distance (so-called radium cannons). There is no doubt in my mind but that the new types of roentgen apparatus which are already completed but are not yet in general use and which are operated with 0.5 ma and are attachable to any lighting system will dispense with the radium cannons. The mathematical fixation of the dosage with the various modes of operation (strong or weak intensity, slow or rapid irradiation) is important. It has been shown that the statement that so-and-so many r are employed has no precise meaning as regards the biologic reaction unless the minute-r-afflux—a term that we cannot get around—is added. The increase of dosage required for a slow afflux is exceedingly high. That with a slow afflux we must irradiate longer goes without saying, for example, in order to obtain 400 r with a 10 r minute-afflux we must irradiate 40 minutes, and with a 4 r minute-afflux, 100 minutes. But the 400 r with a 4 r minute-afflux do not produce the same biologic reaction as the 400 r with the 10 r minute-afflux. In order to secure the same biologic reaction, we must apply about 800 r, and thus irra-

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The skin reaction depends to a gre tent on the minute-r-afflux. With a ration of the irradiation times, and thus intensities, the differences in the rea are, indeed, considerable

The tentative practical deductions the experiments are. With an irrad intensity of 10 r per minute, we can 1,400 r in one day in two equal partial with an interval of from three to six h without endangering the skin. By produc ing an interval of 24 hours, even 4 r are well borne. With a further reduc of the irradiation intensity to a mint afflux of 4 r, a further increase of the age is possible

case, which the speaker referred to as unusual in this disease, induces me to give a short report of an observation of my own. The patient was two years old, with generalized periosteal apposition (*sic*) streaks of several layers on nearly all the long bones, and a leukemic blood picture. We considered the case at the time as similar to a multiple periostitis, with myeloblast anemia, as reported by Jaksch. The case was published in the reports of the Wilhelminenspital. I should like to ask the speaker what relations, if any, there are between Albers-Schonberg disease and such rare disease symptoms, with generalized periosteal thickening of the bones. The speaker has called my attention to the fact that this publication is not by Feyrter but by his predecessor, Oesterlin, and is entitled "Ein Fall von kombinierter Knochen-Bluterkrankung" (*Arch f Pathol Anat und Physiol*, 1923, CCXLVII, 588)

DR WINDHOLZ (closing) Albers-Schonberg disease has little in common with the symptomatic (reactive) osteoscleroses that appear in combination with leukemias, other than the morphologic behavior of the bones, which is in many respects similar. Albers-Schonberg disease appears for the most part in a familial form and is often congenital. It is characterized by a high degree of fragility of the bones. The anemias that accompany it are regarded as secondary manifestations. The aforementioned osteoscleroses develop after chronic leukemias, for the most part at an advanced age, and show no abnormal fragility of the bones. In a case that came to necropsy there was a chronic myeloid leukemia, with a large tumor of the spleen. The long bones were thickened and showed high-grade sclerosis; the marrow cavity and the substantia spongiosa were scarcely recognizable. In the case of Jaksch there was a periostitis without a diffuse osteosclerosis.

diate not 100 but 200 minutes. This fact is not self-evident, nor is it sufficiently known. The determination of exact relations expressible in figures is the aim and content of the Pape researches.

DR KRISER The highly pigmented border on the medial and cranial side of the irradiated abdominal field is not, in my opinion, produced by electric charges, but is, I think, caused by other factors.

I have observed on inspection that, owing to the curvature of the abdomen, these sides of the field lie nearer to the tube focus than the caudal and lateral sides of the field. Owing to the lesser focal-skin distance, this side of the field up to the borderlines covered with a lead screen receives a correspondingly greater amount of rays than the side of the field that is more distant from the focus. Secondly, the lead screens absorb the whole mass of rays and give off only at the edges that border the field the hardest rayage in the form of secondary irradiation, which constitutes a dosage supplementary to the dose applied directly to the skin.

Thus the H E D plus the lesser focal-skin distance, plus the secondary irradiation of the protective material, taken together, produce a greater linear effect, which is visible as a darker pigmented border.

Dr PAPE (closing) The deductions of Dr Borak are based on a mathematically erroneous conception. He compares the effect of irradiation given in fractioned doses over a period of two weeks with the effect of a change in intensity of irradiation in the ratio of 1:3, and reaches the conclusion that the fractioned irradiation which is superior in this special case is superior by reason of the special principle involved. With equal right, however, one might assert the opposite for example I compare the effect of a change in irradiation intensity 1:100 or 1:1,000 with the effect of a simple division of the dosage into two parts and

application with only a one-hour interval. Thus one would reach the conclusion that the change in intensity has more effect than the fractioning of the dosage. In judging the effect of fractioning the dosage, we must consider not only the total dosage but also the number of single doses and the intervals between them.

DEMONSTRATION OF A CASE OF ALBERS-SCHONBERG'S DISEASE

DR WINDHOLZ The patient was an 11-months-old child, who was referred to the Holzknecht Institute with a bilateral atrophy of the optic nerve. The child was the offspring of an incestuous connection. In addition to the high-grade atrophy of the optic nerve, there was a mild anemia, a square-shaped head, and a rigid thorax. The roentgenologic examination revealed a marked increase of the thickness and likewise the density of the bone-marrow spaces, whereas the substantia spongiosa was not recognizable. The metaphyses were swollen and knotted and dark transverse streaks passed through them. There was no disturbance of ossification and no fractures. Periosteal apposition (*sic*) streaks were visible on the inner surface of the tibia and the ulna. The Wassermann test was negative. There was a hereditary malformation of the skeleton. A simultaneous disturbance of the phosphorus metabolism was not to be excluded.

DISCUSSION

DR R KIEVBOCK The disease in children was first described in detail by Laurell and Wallgren, in 1920, under the name "osteosclerosis infantilis generalisata fragilis". In the present case, strange to say, no fractures were observed.

DR F FLEISCHNER The observation of periosteal apposition (*sic*) streaks, in his

92), the court held that the Industrial Commission had no jurisdiction over the amount of Dr Hoyt's fee, as the latter had not elected to come under the compensation law.

Still another decision is cited from the same court, in which an employer had engaged a Centralia physician to care for an injured employee and refused to pay the bill for same, claiming that the fixing of the amount of the fee should have been done by the Industrial Commission.

In this decision the Court said "We find nothing in the Workmen's Compensation Act that makes it obligatory upon a physician who is retained by an employer to treat his injured employee, to submit his claim for such services to the Industrial Commission for its determination, nor is jurisdiction conferred upon said Commission to do so. In our opinion the court properly sustained

the demurrer to the plea and the judgment should be affirmed."

In a case before the Indiana Court of Appeals—*Sullivan vs The National Car Coupler Co* (Ind.), 126 NER 494, 73 Ind App 442—almost identically the same decision as the last two was rendered.

Reasoning from the foregoing reviewed and decided cases, it would seem that we are fully justified in the statement that the industrial commissions or boards have no jurisdiction, and, in fact, nothing whatsoever to do with fixing the amount of the fees of physicians in industrial injuries or for services to patients of any sort or character, and we are not and cannot be made to be controlled or regulated as regards the amount of our fees in this or any other particular by these bodies.

CASES OF INTEREST TO RADIOLOGISTS

ROENTGEN INJURY AS EVIDENCE OF NEGLIGENCE IN A DIAGNOSTIC PROCEDURE

Ragin vs Zimmerman (Calif.), 276 PR 107

A nurse employed by the defendant, Zimmerman, a dentist, tried to take a roentgenogram of the plaintiff's chin. The plaintiff was electrically shocked and burned in the process. From a judgment in his patient's favor, Zimmerman appealed to the Supreme Court of California. In his appeal, he assumed that the doctrine of *res ipsa loquitur* had been applied in reaching a verdict against him, and he combated the application of it to malpractice cases. The Supreme Court found nothing in the record to indicate that the trial court was influenced by that doctrine, but it did find that the cases cited by the defendant to show that the doctrine was not applicable in malpractice cases brought against physicians, surgeons, and

dentists for errors in the treatment of disease had no application in the present case, because the appellant was not employing the roentgen rays for treatment when his patient was injured. While the Supreme Court found no reason for applying the doctrine to the present case, the Court would not hesitate, it said, to apply it to the facts described by the evidence if there were occasion for doing so. It quoted with approval *Evans vs Clapp* (Mo App.), 231 SWR 179, as follows:

As hereinbefore stated, the X-ray was not applied in this case for purposes of treatment but merely to ascertain the cause of plaintiff's headaches, and this was disclosed at the first examination. There is no room, therefore, for the application of a treatment intended to be applied in the accomplishment of a result similar to the one produced but not to the extent thereof. On the contrary, the X-ray was to be used only to discover a condition which was at once shown, and the many other exposures were not made in the interest of the patient,

MEDICO-LEGAL DEPARTMENT

FEES

INSURANCE COMPANIES OR INDUSTRIAL COMMISSIONS HAVE NO JURISDICTION
OVER MEDICAL FEES

By I S TROSTLER, M D, F A C R., F A C P., CHICAGO

The question as to whether physicians or surgeons must accept such fees as are fixed in amount by industrial commissions or insurance companies has come up several times in discussions in the writer's presence and he has been asked about it by radiologists in Wisconsin, Indiana, Ohio, Pennsylvania, and Illinois.

In each of the replies to the eight radiologists who have asked this question he has replied, that, as far as he has been able to learn, the industrial commissions in the States named have no more right to fix medical, surgical, or radiological fees than they have to regulate the width of sidewalks or the weight of watermelons. In Illinois it has been decided in several cases which were appealed from the courts of original jurisdiction that "The Industrial Commission has no power as between the physician and his patient, to determine the amount of the fee to be charged for any medical service. In the absence of a contract between the physician and the patient regarding the amount of the fee, the physician may collect a fair and reasonable fee for his services, any finding, ruling, regulation, or decision by the Industrial Commission to the contrary notwithstanding."

In *Noer vs George Jones Lumber Co* (Wis.), 175 N W R 784, 170 Wis 418, the Wisconsin Supreme Court said "The Workmen's Compensation Act deals exclusively with matters growing out of the relation between employer and employee. The provisions of that Act are binding upon employers and employees electing to be bound by them, and upon none others. All except

employers and employees are strangers to the Act, and their usual lawful rights and remedies are unaffected by it."

In a case appealed to the Illinois Court of Appeals, the verdict of the lower court (in favor of a physician who sued for his fee) the defendant in the original trial claimed and contended that the Industrial Commission had the right to fix the amount of medical and surgical fees in industrial compensation cases. In rendering its decision in favor of the physician the Court said "The question to be decided is whether it was the intention of the legislature, in the enactment of the provisions on which the defendant relies, to take away from the employer and a third person (in this case the physician) their right to contract with each other. Considering the whole Act in connection with these provisions, we think it is apparent that such was not the intention of the legislature. The theory upon which our Compensation Act is based is that the parties to whom it applies—the employer and his employees—must voluntarily elect to come under its provisions. It is when they have so elected that the Act deprives the courts of their jurisdiction to enforce contractual terms between them. The manner in which they shall come under the Act is the same by which physicians, if they elect, may voluntarily come under its provisions."

This consideration has been held to be controlling in the construction of similar statutes in other States.

In another Illinois Appellate Court case (*Hoyt vs London Guarantee and Accident Co* and *Nokomis Coal Co*, 227 Ill App

usually manifests itself after the first treatment and occasionally after the second, but none of them had ever seen a case after the third treatment. The Supreme Court, therefore, concurred in the opinion of the Court of Appeals that the burn in this case could not have resulted from an idiosyncrasy.

There was evidence to show that the defendant did not uncover and examine the area to be treated on the occasion when the burn was inflicted. Concerning this, one of the expert witnesses said "Just because a patient has stood a certain amount of roentgen-ray therapy on previous occasions is no criterion by which the doctor can be guided as to future treatments. The area to be exposed ought always to be examined before exposure is given."

The occurrence of a roentgen-ray burn, even after 160 treatments had been safely given, would indicate, this witness testified, "that before the last exposure was given there was a definite indication upon the surface of the skin which even to the semi-trained eye would indicate that he was treading on dangerous ground, or second, that there was some mistake of the technic or some error of judgment in giving the amount of the exposure that was given at that time, which was sufficient in itself to cause a roentgen-ray burn of the severity as described."

The Supreme Court concurred in the opinion of the Court of Appeals that under the doctrine of *res ipsa loquitur* there was sufficient evidence to take this case to the jury. The Supreme Court quoted 20 R C L 187.

More precisely, the doctrine *res ipsa loquitur* asserts that, whenever a thing which produced an injury is shown to have been under the control and management of the defendant, and the occurrence is such as in the ordinary course of events does not happen if due care has been exercised, the fact of injury itself will be deemed to afford sufficient evidence to support a recovery, in the absence of any ex-

planation by the defendant tending to show that the injury was not due to his want of care.

The reason generally assigned for rejecting the doctrine of *res ipsa loquitur* in a case such as that before the court is that it does not take into account the idiosyncrasy of the patient, which is occasionally responsible for the burn. In this case the conclusion seemed inevitable that the burn could not have resulted from an idiosyncrasy. *Res ipsa loquitur* means merely that the facts warrant the inference of negligence, not that they compel such an inference. They furnish circumstantial evidence of negligence where direct evidence may be lacking, but such circumstantial evidence is to be weighed, not necessarily to be accepted as sufficient. It calls for explanation or rebuttal but does not necessarily require it. It makes a case to be decided by the jury but does not forestall the verdict. When all the evidence is in, it is for the jury to determine whether the preponderance is with the plaintiff.

The action of the Court of Appeals in reversing and remanding the case for a new trial was correct, and the petition for the defendant for a writ of *certiorari* was therefore denied.

LIMITATION BEGINS TO RUN WHEN TREATMENT CEASES

Schmitt vs Esser (Minn.), 226 N W R 196

In malpractice cases there is difficulty in determining the precise moment when the act or omission which caused the damage took place. The neglectful or unskillful act may occur at some particular moment during months of attendance on the patient, or it may persist and characterize the whole treatment. It would seem advisable, therefore, not to apply the bar of the statute of limitations unless it clearly appears from the complaint that the unskillful or negligent act which caused the injury antedated the action by a period greater than the statutory pe-

but for other purposes Examinations, when carefully and properly made, do not produce burns, hence when a burn is produced, this fact is of itself some evidence from which the jury may find that the degree of care and skill ordinarily exercised by persons of like profession and using such agencies was not exercised in that particular case *George vs Shannon*, 92 Kan 801, 808, 142 P R 967, Ann Cas 1916B, 338, *Shockley vs Tucker*, 127 Iowa 456, 103 N W R 360

The judgment of the trial court in favor of the injured patient was, therefore, affirmed

FAILURE TO USE ROENTGEN RAYS IN REDUCING FRACTURE IS VERY COSTLY TO PHYSICIAN

Stoll vs Balasz (Ohio), 167 N E R 522

A kick by a horse fractured the tibia and fibula of the patient's left leg Stoll, a physician, attempted to reduce the fracture, but at no time in the earlier stage of his employment did he use roentgen rays to guide him in diagnosis and treatment According to the record, a ligament or tendon got between the ends of the broken bones and prevented union When roentgen rays were finally used, they disclosed a space of from three-sixteenths to one-half inch between the ends of the bones This, according to the record, resulted in an infection and sloughing off of bone, so that plates had to be used to bring the ends together to procure union Ultimately there was a shortening of the leg There was evidence to show that it was the customary and usual practice to use roentgen rays in the reduction of fractures, and, while they would not show a ligament or tendon between the ends of fractured bones, they would show that the bones had not been properly set so as to permit union There was evidence to show, too, that the ultimate process of curing the infection and procuring union was exceedingly painful and that the patient's crippled condition was

permanent The jury returned a verdict in favor of the patient for \$20,000 On appeal by the physician, however, the Court of Appeals of Ohio, Cuyahoga County, concluded that the verdict was excessive The jury, said the Court, probably took into consideration the pain and suffering that the patient had to endure by reason of the horse's kick which was no part and could be no part of a judgment rendered against the attending physician, because he was in no way responsible for it Nevertheless there was ample evidence to justify a verdict against the physician It was ordered, therefore, that the judgment of the court below be reversed unless the patient remitted \$5,000 of the verdict and accepted \$15,000 in settlement

RES IPSA LOQUITUR IS MADE TO APPLY IN ROENTGEN DERMATITIS

Lewis vs Casenburg (Tenn), 7 S W R (2d) 808

"The area to be exposed (treated) ought always to be examined before exposure is given"

The defendant, Casenburg, administered 161 roentgen-ray treatments to a Mrs Lewis, extending over a period of six years After the last treatment a third degree dermatitis appeared on her abdomen, covering a space of 7 by 9 inches and sloughing off "practically to the lining of the intestine" Mrs Lewis died, but whether from the effects of the injury or from some other cause the record does not show Her administrator sued to recover damages for the injury done by the burn The trial court directed a verdict for the defendant The Court of Appeals, however, reversed the judgment of the trial court and remanded the case for a new trial Thereupon the defendant petitioned the Supreme Court of Tennessee for a writ of *cetiorari* in order to obtain a review of the case by the court Practically all of the experts testified that idiosyncrasies

INTERPRETATION OF ROENTGENOGRAMS

Appleby vs Cass (Iowa), 229 N W R 210

Appleby's right temple was injured in a collision between an automobile driven by him and an automobile owned by Cass. He sued Cass. In the course of the trial, one of Appleby's physicians undertook to explain to the jury the significance of various features of a roentgenogram itself offered in evidence. Counsel for Cass objected, asserting that this was not proper testimony and that the roentgenogram itself was the best evidence of what it showed. The objection was overruled. The jury rendered a verdict in favor of Appleby, and Cass appealed to the Supreme Court of Iowa.

In *Elzig vs Bales*, 135 Iowa 209, 112 N W R 540, the Supreme Court of Iowa held that a photograph was itself the best evidence of what appeared in it, and in *Lang vs Marshalltown L P & R Co*, 185 Iowa 940, 170 N W R 463, it applied the same rule to a roentgenogram offered in evidence to show a curvature of the spine, the question being only whether it showed a straight line or a curved one. In the latter case the roentgenogram served a purpose similar to that of a photograph. In *Daniels vs Iowa City*, 191 Iowa 811, 183 N W R 415, 416, however, the Court opened the door to expert evidence offered for the interpretation of a roentgenogram, saying:

It is proper for an expert to explain an X-ray photograph in such particulars that are not understood by a layman. (See *State vs Matheson*, 142 Iowa 414, 120 N W R 1036, 134 Am St Rep 426.) What the jury could see and understand about the matter is not the subject of expert testimony, and this we understand to be the effect of our prior decisions. A radiograph may be used for purposes of demonstration by an expert as though he had the object itself before the jury for explanation (*Sheldon vs Wright*, 80 Vt 298, 67 A P 807).

The Supreme Court might properly, it

said, take judicial notice of what is well known to the profession, namely, that a roentgenogram does not necessarily or ordinarily interpret itself to the observation of a non-expert. A roentgenogram carries various lights and shadows the significance of which is known to the expert and is not known to the non-expert. In the present case the purpose of the roentgenogram was to show the existence and location of a "perforation of the temple." The physician in the case had diagnosed "hole" in the temple. This "hole" was indicated by the experts by certain characteristics of light and shadow in the roentgenogram. It was not observable as a "hole" on the ordinary scrutiny of a non-expert. The purpose of the expert testimony was to explain the meaning of the lights and shadows in the roentgenogram. Such an explanation was essential to a proper understanding of it and the admission of expert testimony for that purpose was proper. Only when a roentgenogram is offered in evidence to serve nothing more than the function of a photograph is it subject to the rules of evidence applying to photographs.

The judgment of the trial court was reversed, however, on grounds not pertinent to the subject matter of this abstract.

COLLECTION OF PHYSICIAN'S FEES FOR SERVICES TO INJURED WORKMEN

Wilson Drilling Co vs Beyer (Okla), 280 P R 846

The Workmen's Compensation Act of Oklahoma, says the Supreme Court of Oklahoma, is not concerned with claims against employers, except such as are incident to pending claims of workmen or their dependents, for compensation based on injuries to workmen. Medical services are covered by the Act only as they are ancillary to its prime purpose, relief for the injured employee. A physician treating an injured

riod of limitations "We think," said the Supreme Court of Minnesota, "that the treatment and employment of a physician should be considered as a whole and that, in event of malpractice, the statute of limitations begins to run when treatment ceases."

DEATH FROM ROENTGEN INJURIES

Hess vs Rouse (Texas), 22 SWR (2d) 1077

The defendant, Hess, a physician, administered three roentgen treatments. The first was applied to his patient's abdomen. A few days later a treatment was applied to her back, followed in a few days by the third treatment, also to her back. In a short time, apparently after the last treatment, a third degree dermatitis developed covering an area of about 4 by 7 inches. The tissues under the burned area sloughed off "down to the lining of her intestines," and the patient died. Her husband and children brought suit. Judgment was rendered against the defendant for \$8,467.50. He appealed to the Court of Civil Appeals of Texas (Austin), where the judgment was affirmed.

Physicians testified that a third degree burn is ordinarily the result of (1) administering roentgen rays of too great strength, (2) not focusing at the proper distance, (3) continuing the treatment for too long a time, (4) using the roentgen-ray machine without a proper filter, or, at all events, a failure of the physician to observe some established method or rule of administering roentgen therapy. Testimony was offered to show that occasionally a patient possesses an idiosyncrasy or supersensitiveness with respect to roentgen rays and is more liable to be burned than is the ordinary patient. The existence of an idiosyncrasy in the present case, however, said the Court of Civil Appeals, was fairly negatived through testimony showing that when an idiosyncrasy exists it extends alike to all parts of the

body and is ordinarily detected in the first or second treatment. The deceased was burned from one of the treatments, but not from the other two. The evidence was sufficient, said the Court, to warrant the jury in finding that the defendant failed to use the reasonable degree of care, skill, and diligence in treating the deceased with roentgen rays that is ordinarily used by the average members of the medical profession in good standing in the community where the injury occurred, under the same or similar circumstances, and to warrant it in concluding that such failure was the direct and proximate cause of death. This, said the Appellate Court, is the test of liability in a case of this character.

The defendant moved for a new trial, alleging that he had discovered after the trial that another physician had applied "Iodex" and "Antiphlogistine" to the burn on the body of the deceased, applications contra-indicated in roentgen burns and which, if used to any great extent, cause a breaking down of the tissues and lead to the death of the patient. The defendant, himself, however, treated the deceased until her death. Certainly, said the Court, he should have detected any improper treatment by other physicians, who occasionally treated the deceased in his absence. The plaintiffs, when they started this suit, admitted that they had employed other physicians to treat the burn, and common reason should have suggested to the defendant that it was important for him to ascertain what medicine had been used by them. The evidence shows simply that the defendant did not exercise any degree of diligence to obtain such information. As one essential to granting a new trial on the ground of newly discovered evidence is that the party asking for a new trial could not have obtained such evidence by a reasonable degree of diligence before the trial, the trial court did not err in overruling the defendant's motion.

The primary purpose of the statute is not, however, to provide compensation to physician, but solely to provide compensation to the injured employee for such medical service as the law permits him to procure at the expense of his employer. It does not, therefore, provide for any award to a physician, but merely gives the physician a lien upon the compensation awarded to the workman, which "shall be paid therefrom only in the manner fixed by the Commission"

Because the claim filed by the physician in the present case could not be considered by the Industrial Commission in the absence of a claim for compensation filed by the injured workman, and because the injured workman had not filed such a claim within the time limited by law, one year after the injury, the Supreme Court reversed the order of the Industrial Commission awarding the physician compensation for his services and directed the Commission to dismiss his claim

WORKMEN'S COMPENSATION ACTS

"ACCIDENT" DEFINED

Carr vs Murch Bros Const Co (Mo), 21 SWR (2d) 897

An unexpected and unforeseen result of a usual and intentional act or movement done in the ordinary course of employment is an accident within the meaning of Paragraph (b) of Section 7 of the Missouri Workmen's Compensation Act, which defines "accident" as meaning "an unexpected or unforeseen event happening suddenly and violently, with or without human fault and producing at the time objective symptoms of any injury"

The strangulation of an old hernia, that resulted from reaching up in the ordinary course of employment to manipulate a steam valve, is an accident within the meaning of the law, and the injured employee is entitled to compensation, according to the Missouri Supreme Court

employee may resort to the courts for the collection of his claim either against the employer who authorized his services or against the employee to whom they were rendered. The Industrial Commission cannot hear and determine a physician's claim for payment for professional services to an injured employee, unless the employee has filed with the Commission his claim for compensation.

In the present case the appellee, Beyer, filed with the Industrial Commission more than two years after the injury an attending physician's report showing that he removed a piece of steel from the right eye of an injured employee of the appellant. The injured employee filed no claim for compensation and no award was made to him. The Industrial Commission, however, awarded his attending physician, Beyer, \$100 for his professional services. The employer thereupon appealed to the Supreme Court of Oklahoma.

The question presented, said the Supreme Court, is whether proceedings to recover payment for professional services in treating an injured employee can be instituted by a physician independent of proceedings by the employee to recover compensation for the injury or are necessarily supplementary to proceedings instituted by the injured employee, in other words, can the claim of the physician, standing alone, be heard and determined by the Industrial Commission, or is it necessarily relegated to the courts of law? The Supreme Court quoted Robinson *vs* Taylor, 116 Okla 131, 244 P 44, 47, in which an award had been made for the benefit of a physician and a hospital, ancillary to the main case, and in which the Court said:

It was further contended that the Commission was without power to make an award direct to the doctor and the hospital. The contention is correct, and if, independent of the main case, the doctor had presented his claim or the hospital had presented its claim, we

should say that the Commission had no jurisdiction.

In *Scruggs Bros & Bill Garage vs Commission*, 94 Okla 187, 221 P R 470, 475, question arose as to the right of the Commission to make an award direct to the physicians who had treated an injured employee. The injured employee, who was claiming compensation on his own account, had not paid the physicians for their services and a claim for payment for medical services was therefore filed independently of his claim. In that case it was held that it was not improper nor beyond the authority of the Industrial Commission to award both claims to the injured employee, but the Commission should have declared a lien on the amount awarded the injured workman, in favor of the physician-claimants, for the amount found to be due them. The Court said:

We think the Commission was in error in making this supplemental order for two reasons, the first being that claims arising under the workmen's compensation law are matters strictly arising between the injured employee on the one side, and the employer and his insurance carrier on the other. Differences between the employer and his insurance carrier and third persons are not cognizable before the Industrial Commission.

In *Associated Employers' Reciprocal vs Commission*, 87 Okla R. 16, 208 P R 798, 801, the Court said:

But where the employer voluntarily furnishes medical services, it is a matter of contract solely between the employer and the physician, and the Industrial Commission has no jurisdiction of such matter. But where controversy arises, the parties are relegated to the courts for an adjudication of the matter.

In *Bloom vs Jaffe*, 94 Misc Rep 222, 157 N Y Supp 926, 927, it was held

apparatus, and increased accuracy and efficiency of therapeutic dosage, all are the fruits of painstaking research. But in all this enthusiasm in building a fine healthy youth, I fear we have been remiss in teaching him some of his manners, so that he may appear in respectable society without embarrassment to his elders. I believe you apprehend my meaning that it is most necessary that this young specialty be made to occupy the dignified relation to the general medical profession and public which its importance warrants.

Let us look briefly over the life of this growing youth from the beginning up to the present, review some of the important influences that have had an unfavorable effect upon his life, analyze them briefly, and finally try to offer some suggestions for improving this situation, with the object that this specialty may deservedly occupy a more dignified position than it appears to have occupied up to the present moment.

One of the most important unfriendly factors that we have to face is the attitude of our medical practice laws. Beauty parlors, shoe stores, laymen, chiropractors, and all sorts of parasitic growths that have attached themselves to the medical body, are allowed to use the roentgen ray at will and without hindrance. The implication is obvious, that the practice of radiology is not the practice of medicine. What a great injustice, that a medical law may say that a person not duly qualified may not legally prescribe a dose of quinine, which, if you give too much, causes only an unpleasant ringing in the ears, but that anybody, qualified or not, may administer a dose of the roentgen ray, which, if too large, may do irreparable harm.

It is hard sometimes to understand why medical laws appear in so many instances to have an unfriendly attitude toward that great body of the medical profession, which is doing so much for the relief of the suffer-

ing of mankind. Perhaps this is not difficult to understand when one has had occasion to meet certain units of the legislative bodies that are making the laws, that are manifestly swayed either by the weight of their own ignorance or by a prejudice cultivated in them by some of the groups of medical parasites whose mental mechanism, being more nearly of the same caliber as their own, impresses and influences them more easily.

Several years ago two prominent radiologists of San Francisco and I made a pilgrimage to our State capitol to remonstrate with a certain committee that was contemplating a law to license lay radiographers. It certainly was far from an exhilarating and encouraging experience to find the laws governing the practice of a learned profession being manipulated by men who had positively no conception of the principles with which they were dealing, and who were obviously laboring under the pressure of forces quite inimical to the medical profession. By some unaccountable mistake, a legislator who was a member of our own profession was on that committee, and he proved our only salvation in this case.

What can we do about this? Medical laws, particularly as they affect the radiologic profession, must eventually be changed. This Society has its Legislative Committee which has been active. It deserves our whole-hearted co-operation.

I sometimes wonder, however, if the medical profession may not have participated too deeply in legislation at times, and may not have come out of it without much gain.

It has at times seemed necessary to organize certain bodies with the express purpose of taking an active part in politics insofar as they touch on medical legislation. These organizations have done some good work, but I can never forget the time when a large and prominent state medical society was on

EDITORIAL

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Radiological Society of North America*

WHITHER THE RADIOLOGIST?¹

During my perusal of the periodicals devoted in whole or in part to radiology, I have been impressed in recent weeks by the frequent appearance of articles and editorials dealing, not with the scientific side, but, let us say, with the sociologic and economic phases of our specialty. Since these same phases have been a great deal upon my own mind, I resolved that I would make an effort to focus a discussion on this subject.

Many of the leaders in our science have expressed their concern, in print and otherwise, over the status of our specialty, and I was interested to see, in the minutes of the last meeting of the American College of Radiology, the record of an extended discussion of this subject.

There must be some reason for this matter coming up in the minds of so many of us who are so widely separated over the country. It must mean that many of us feel that there is something in our menage that needs adjustment, that there are some common evils in our profession that are general, no matter in what location we are practising.

These articles have dealt generally with the status of the radiologist, both in hospi-

tal and private practice, his relation to the other branches of medical practice, and the general trend of the estimation of his work by these other branches. The question has been asked, "Is radiology moving toward complete recognition as one of the most highly specialized branches of medicine and surgery, or is it being hampered in its progress by certain conditions and influences which have been ignored or disregarded too long?"

No apology is necessary for the introduction of this topic into a session otherwise devoted to purely scientific deliberations. It will do us no harm to glance up occasionally from our absorbing scientific investigations to take a view of the horizon and the stars, get our bearings, so to speak, then we can return to our browsings for a while longer.

We assume with assurance that our specialty is an honorable one, one eminently worth while, that it deals with a most fruitful source of information in the *diagnosis* of disease, and with one of the most potent of all principles in the *therapy* of disease, that it touches intimately every other branch of medical practice, from the standpoint of both diagnosis and therapeutics.

Radiology is a relatively young science, and for that reason it may display many of the frailties of youth, but I dare say also that radiology displays much of youth's vigor, enthusiasm, and vision. Those of us who have dedicated our lives to this young science would like to feel that we are doing our best in every way to further its progress and to enhance its usefulness. Many of our number are performing wonderful service in making this youth grow to a strong lusty man physically, that is, rapid strides are being made in the *science* of radiology. New and valuable diagnostic methods, perfected

¹Read before the Radiological Society of North America
at the Sixteenth Annual Meeting at Los Angeles, California
Dec. 1-5, 1930

cal and professional sides of the work Better no X-ray service at all than one used in the casual manner prevalent in many general practitioners' offices

In my early years of general practice I remember well hearing a prominent diagnostician, for whom I had great admiration, say that he made all his own observations of the eye grounds, whereupon I immediately purchased for myself an ophthalmoscope After trying for a while to use it, I laid it aside and never used it again, preferring to have the ophthalmologist do that work for me, and deciding that either I was very stupid, or my internist friend was not so smart as he thought he was

However, our attitude toward the general practitioner who is trying to do some X-ray work should be one of friendly sympathy and helpfulness Nothing is to be gained by a spirit of resentfulness to the invasion of our special field The physician should be encouraged to bring his films to us for examination and advice Nothing will convince him sooner of the fallacy of the idea that the practice of radiology is a simple affair, to be mastered after a few days of instruction from a salesman

The disposal of the films taken in the course of roentgen-ray examination is also open to discussion The value of the film itself is too often unduly stressed It is my opinion that the X-ray films are for the use of the profession only, and that the placing of the films in the hands of patients or friends, following an examination, only tends to encourage the idea that it is films they pay for instead of a medical opinion This practice exposes the patient further to the injustice of having these films interpreted by unqualified persons, and in some instances to being led to unnecessary and even dangerous treatment

The compensation insurance companies are offenders in basing their compensation to the radiologist on the number and size of

films taken I will confess that it ruffles me not a little every time I am required to stipulate these figures, as though we could deal out roentgen diagnosis by the square inch I realize the obvious fact that frequently a vastly more important diagnosis, both to the patient and to the insurance company, is made from the evidence on a small 5×7 film than in another case on several 14×17 films

Such conditions as these tend to put the roentgen laboratory on the basis of a photograph gallery Some time ago this fact was brought very forcibly to my mind, when the operator in a prominent local photograph studio was referred to me for X-ray examination When he appeared for the work, he began by asking me in all seriousness if there would be a professional discount

The most serious blot on the name of the science of radiology is the lay laboratory, and its attendant ills It is largely the outgrowth of the laxness of our medical laws, combined with the short-sighted, selfish attitude of a certain proportion of the medical profession

The X-ray laboratory, run solely by lay hands and catering to the undiscerning of the medical profession, is an almost unmixed evil No less so is the laboratory to which a graduate in medicine, forgetting the high ideals of his profession, has lent his name, in order to give it a semblance of respectability, but in which he takes no directing part whatsoever

Most pernicious and disgraceful is the laboratory, whether lay, professional, so-called "co-operative," or what you will, that participates in that subtle form of fee-splitting known as the rebate It is a peculiar mental quirk that will permit a physician in good and honorable standing in his local and national medical associations to hold up his hands in holy horror at the suggestion of splitting a fee with another physician, yet

the point of organizing the lay technicians of the State into a society, to be associated with itself, the movement being largely fostered by a political organization allied with the state medical society. This plan did not succeed, due to the active efforts of some very wide-awake radiologists in that society. It is only fair to say that this was several years ago and probably would not happen now.

While I repeat most emphatically that our present medical laws are unjust in respect to the radiologic profession and must be eventually changed, I am not advocating active campaigns for the change of these laws at the present time, because I believe there are conditions closer at home which should be remedied first.

I believe we have also been done an injury, unintentionally, no doubt, by the efforts of assiduous salesmen of X-ray apparatus. Urged by pressure from the sales manager and the very pardonable desire for commissions and advancement, they have canvassed the entire medical profession, both regular and quack, and succeeded to no small degree in persuading a goodly proportion of the profession that the ownership of X-ray apparatus, plus a few instructions from the salesman as to the location of certain switches and buttons, constitutes them full-fledged radiologists. These salesmen have appealed to the very natural desire for financial gain by painting glowing pictures of the marvelous prosperity of those engaged in radiology (*sic!*), and have loaded some of them with an array of apparatus and accessories that would bewilder many an experienced worker.

Hear this excerpt from the advertisement in a leading surgical journal, of one of our large manufacturers of X-ray apparatus: "Apparatus so perfected that its safe and satisfactory operation requires no specialized training." Further in the same advertisement we read, "Make your own X-ray

examination!"—and then, almost sensing a recoil from some irritated radiologist, there follows, "Consult your roentgenologist in doubtful cases."

It is the experience of most of us, I am sure, that the ordinary practitioner is not aware of the confines of that borderline of doubt—doubt which often first appears to enter his mind when a patient of upwards of two hundred pounds confronts him, and he wonders if he can do the case justice with his particular machine. Needless to say, none of these suggestions appears in any of the advertisements in the radiologic journals.

Seldom are these salesmen found to advise prospective customers, in the words of the familiar automobile advertisement, "Ask the man who owns one." Too often that man would tell the physician this scheme is a snare and a delusion, that he has a white elephant on his hands that will not pay for its keep, and while he is wasting time and materials trying to get some sort of image on a film, to say nothing of learning what it means, he could advise with several patients along lines in which he is better qualified, with greater profit to the patient and to himself.

It is obvious we can do nothing about this situation. The manufacturer is bent on establishing a larger volume of business—no matter where his product goes. If this volume should result in diminished cost of apparatus, we might all benefit by it, but so far this has not happened to any noticeable degree. In full justice to our medical confrères who live within easy reach of a competent radiologist, it is only fair for the radiologist to speak frankly when his advice is asked concerning the purchase of X-ray equipment. The physician should be reminded of the great expense attached to the use of X-ray apparatus, the increased hazards, the greatly increased insurance premiums, and the necessity of conscientiously giving a large amount of time to learning the techni-

go far toward maintaining the attitude of the roentgenologist and technician toward each other as a happy one

Admitting the importance of all these external influences, there is to my mind a problem much nearer home which demands solution, the close and conscientious attention to which will go further than any one thing toward enhancing the value of the radiologist in his medical community, and bringing him to that position of recognition which the importance of his specialty deserves. Our great fault, I believe, is the position so many of us have assumed of isolating ourselves from the clinical practice of medicine. We have burned up the roads between various branch offices and hospitals on film-reading expeditions. We have seen little of our patients, except when fluoroscopy was needed, and have neglected even then to take a personal interest in the clinical side of the case. We have failed to discuss cases fully, as we should have done, with the referring physician. We have not acquainted ourselves with his problems in the particular case in which he is seeking our help. How can we expect him to consider us as consultants if we do not even see his patient, or ask for the history and clinical and other laboratory data?

Most emphatically do I assert that until we institute a very distinct reform in this practice radiology will never be considered much more than a mere incidental influence in the diagnosis and treatment of disease. Unless we renew within ourselves the realization that we are practising medicine, first, last, and all the time, we can never expect the profession or the public to recognize us as standing shoulder to shoulder in the front rank with the specializing internist, surgeon, laryngologist, and the other specialties.

In a recent issue of *RADIOLOGY* one of our members wrote a very fitting tribute to a confrère who had died in an Eastern city. Most pointed was the remark, "He was a physician practising radiology." How aptly

put! What a stinging rebuke to those of us who have fallen so far short of the full measure of our usefulness, and whose knowledge of the patient entrusted to us is too often confined to a few square inches of celluloid!

In the progress of our specialty toward maturity we shall find that more frequently the patients are seeking the services of the radiologist first hand. I am sure most of us are experiencing this already. Heretofore we have had all but a very small portion of our work referred by other physicians, and we have been largely depending on the patronage of a profession which is notoriously whimsical. (It is permissible to say this since we include ourselves with the rest.)

I believe that the opinion expressed by Dr. Groover in a recent editorial is correct. We shall find with increasing frequency that patients will seek radiologic advice and service on their own initiative or will suggest it to their attending physicians. It will consequently follow that the radiologist will himself become a referring physician. He will be directing patients to other specialists for certain services. His stock will rise noticeably then. It only remains necessary that the radiologist keep himself *clinically alive*, and maintain his touch with the progress of medicine in other lines. With strict adherence to the ethical principles, with which we are all conversant, he can pursue this course with perfect justice to his referring clientele, and grow in respect and usefulness. He must prepare himself to discuss intelligently, in staff and medical society meetings, all cases that he has contacted or that concern his work, and by "intelligently" I mean with the ability to realize the clinical significance of the case. It is his duty, with becoming modesty, to keep his fellow-practitioners informed of advances in his own line, being careful to avoid a controversial attitude, as though there were some competitive element in the various treatments or methods of diagnosis.

will allow him with marvelous complaisance to accept a check each month as a *pro rata* of the work he has sent to an X-ray laboratory. How can these physicians themselves have any respect for a branch of medical work which indulges in such practices, even though they are receiving gratuities from them?

This disgrace will be abated only when our medical laws are improved, and when the radiologic profession, by its own improved practices, which I shall mention later in the paper, has shown that it can lift the specialty to a higher plane.

Closely allied to this subject is the one which deals with our relation to the radiologic technician. There is none of us but will gladly admit the great dependence we place on an efficient technical assistant. With the increasing facilities for detail work, and the resultant widening usefulness of radiologic diagnosis, the demand for expert technical service is daily becoming greater.

To-day the increasing importance of the highly trained technical assistant in busy radiologic departments may cause undue stress to be laid on this purely technical phase of the work, and, too, we are prone to let patients pass through our offices or departments, seeing only the technical assistants and the bookkeeper, never having a single contact with the professional side of the organization. Little wonder, then, that the public comes to view the layman's services as constituting the entire performance, nor is it entirely unnatural that the assistants, particularly the male ones, may at times, without intention, begin to assume an importance which threatens to be somewhat top-heavy, to say the least.

I was impressed with this fact, and not a little shocked, very recently to read in one of our leading radiologic journals an advertisement which was worded, "Associate wanted [Mind you!] Experienced technician desires to associate with physician in-

terested in X-ray and light therapy. Must be young, progressive, and open-minded."

It reminded me of some recent interviews with prospective domestic help. Before I had a chance to ascertain if they could cook well enough for me to employ them, they were investigating my qualifications as an employer.

Our own history of development may have a certain bearing on this situation. It is a fact that some of our most cherished names in radiologic history are those of men who in their early years were not medical graduates. Such men as the beloved Caldwell and Walter Dodd, as well as some living and active to-day, began as laymen. But all the more significant is the fact that they eventually realized that, without a medical education, even they were not giving a service worthy of its dignity to their chosen work.

The production of a technically beautiful roentgen film of a difficult portion of the body is a work of skill and of art. It is an honor to the man or woman who produces it, and deserving of all praise, often more than it receives. However, just as those illustrious pioneers in radiology who started as laymen found that their usefulness had very distinct limits until they had rounded out their medical education, just so does the lay radiographer of to-day meet a very sharply marked boundary at the point at which his function ends and that of the professional service of the roentgenologist begins. Fortunate is that technician who realizes this fact and complies with its exactations, for he has in store for him years of happy association with the medical profession with the enjoyment of mutual confidence and appreciation. He can gain nothing but distrust and disturbed and unhappy relations by any other attitude.

This Society has done a distinct service in the fostering of the Registry of Radiological Technicians, an organization that has a code of conduct which, if adhered to, will

go far toward maintaining the attitude of the roentgenologist and technician toward each other as a happy one

Admitting the importance of all these external influences, there is to my mind a problem much nearer home which demands solution, the close and conscientious attention to which will go further than any one thing toward enhancing the value of the radiologist in his medical community, and bringing him to that position of recognition which the importance of his specialty deserves. Our great fault, I believe, is the position so many of us have assumed of isolating ourselves from the clinical practice of medicine. We have burned up the roads between various branch offices and hospitals on film-reading expeditions. We have seen little of our patients, except when fluoroscopy was needed, and have neglected even then to take a personal interest in the clinical side of the case. We have failed to discuss cases fully, as we should have done, with the referring physician. We have not acquainted ourselves with his problems in the particular case in which he is seeking our help. How can we expect him to consider us as consultants if we do not even see his patient, or ask for the history and clinical and other laboratory data?

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put! What a stinging rebuke to those of us who have fallen so far short of the full measure of our usefulness, and whose knowledge of the patient entrusted to us is too often confined to a few square inches of celluloid!

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I think we have drawn a little fire of antagonism from certain quarters by an attitude, which we are sure is well founded, on such subjects as the therapy of toxic goiter and certain malignancies. We should be careful in this matter.

Let no one think, who may read this paper, that I am in any way complaining of monetary loss caused by these unfriendly influences. I believe there will always be enough for the qualified radiologist to do so that he will be provided with a decent living. My arguments are purely from the standpoint of the dignity of our profession, for, after all, our richest pay is the joy of

service—through a medium in which we can justly take pride.

All in all, the specialty of radiology appears to me to have a most alluring future in its ability to serve the sick, both directly and through pleasant contacts with the profession. This will be chiefly, not through worrying about medical laws or the numerous pestilences that harass us in the form of quackery and dishonesty, but through the broadening of our medical lives into the full scope of usefulness they should possess, that is, by being "physicians practising radiology."

CHARLES M. RICHARDS, M.D.

COMMUNICATIONS

RESOLUTION

At the Annual Meeting of the Society, held in St. Louis, Nov. 30-Dec. 4, 1932, the following Resolution was adopted:

Resolved, That the Executive Committee of the Radiological Society of North America is authorized and is hereby specifically instructed to employ accountants and clerical help and to take any measures which, in its judgment, are necessary or desirable to put the financial affairs of the Society on a sound business basis, and to enable this Committee to render complete and exact financial statements of the cost of the Society to its members, and of the cost of its Journal to the Chemical Foundation, and to make any further agreement with the Chemical Foundation which, in the best judgment of the members of the Committee, are proper and will tend to enlist its further support.

The adjustment covered by this Resolution is still going forward, necessitating

much labor by members of the Executive Committee and especially our President, Francis Carter Wood, M.D., and our Secretary-Treasurer, Donald S. Childs, M.D. It is hoped that their efforts may result in arrangements whereby the Journal may continue to be a source of satisfaction to its readers.

DISCONTINUANCE OF JOINT SUBSCRIPTION

It has been decided to discontinue the joint subscription rate for *The American Journal of Cancer* and *RADIOLOGY*, as announced in *RADIOLOGY*, December, 1930, XV, 700. The subscription rate of *The American Journal of Cancer* is \$5.00 in the United States, \$5.50 in all other countries. The subscription rate of *RADIOLOGY* is \$6.00 in the United States, Canadian and foreign postage \$1.00 additional.

It is hoped that all physicians interested in radiology are already or will become subscribers to both journals.

SUB-COMMITTEE ON RADIOLOGY

Dr Leopold Jaches, of New York, has been appointed a member of the Sub-committee on Radiology to the International Hospital Association for the study of the care of the patients in hospitals. This honor was conferred upon him by Dr Hans Holfelder. The principal questions to be considered are the following:

- 1 Specialization of the entire field of roentgen diagnosis and radium therapy, its establishment as an independent specialty and its right to independent quarters in the hospital
- 2 Centralization or de-centralization
- 3 Does the radiological division require its own bed units?
- 4 Arrangement and disposition of space and technical adjustment
- 5 Scope and limitations of radium therapy in the hospital and conditions of its application

Dr Jaches is to represent the member from the United States. There are twelve countries in all, each sending one representative.

AN APPRECIATION

Under the assistant-editorship of S W Donaldson, M D, of Ann Arbor, Michigan, *The Journal of Phi Rho Sigma* has issued a Roentgenological Number (January, 1932). It contains papers by B R Kirklin, M D ("Graduate Training in Roentgenology"), L R Sante, M D ("The Economic Phase of Radiological Practice"), James D Bruce, M D ("Post-graduate Teaching of Roentgenology"), Clyde K Hasley, M D ("X-ray Therapy"), and S W Donaldson, M D ("Choosing Roentgenology as a Specialty"). There are splendid editorial comments by Albert Soiland, M D, Jonathan Forman, M D, Walter M Simpson, M D, Norman MacNeill, M D, and S W Donaldson, M D. The *Journal* has a circulation of some 6,000

among medical men and, besides the articles enumerated, contains much material of interest to members of Phi Rho Sigma and Chi Zeta Chi. The editors are to be congratulated upon a publication of real value.

RADIOLOGICAL SECTION OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION

At a meeting of the Radiological Section of the Los Angeles County Medical Association, held December 16, 1931, the following officers were elected for 1932: President, W E Costolow, M D; Vice-president, Karl Bonoff, M D; Secretary, D R MacColl, M D; Councillor, Kenneth Davis, M D; Treasurer, Henry Snure, M D.

DEATH OF MR WILLIAM H DODGE

It is with regret that we have learned of the death of Mr Dodge, on February 1. He has been known to many roentgenologists throughout the country as one of the best X-ray technicians, who took pride in producing fine roentgenograms and in teaching others to do the same. He numbered among his friends leading radiologists and apparatus builders, who had respect for Mr Dodge's ability and maintenance of high standards in his chosen field.

THE RADIOLOGICAL REVIEW
RADIUM NUMBER

The March, 1932, issue of *The Radiological Review* will be entirely devoted to Radium Therapy, this being the fifth annual "Radium Number." Short original articles on clinical radium therapy that will be of interest to the general profession are solicited. All contributions should be in the hands of the Editor (P O Box No 152, Quincy, Illinois) not later than February 20, 1932.

BOOK REVIEWS

THEORY AND PRACTICE OF TELECURIERTHERAPY By MAX CHEVAL and A-P DUSTIN Pages, 240, illustrations, 76 Masson et Cie, Paris, 1931 Price, 34 francs¹

In this work of clinical radiologic and biologic research will be found most valuable technical instruction, as the authors' main purpose was to relieve radiotherapists seeking information in this field of the inevitable initial uncertainties.

This volume, which sums up a three-year experiment along clinical and therapeutic lines, consists of three divisions.

The first part is devoted to the organization of a telecurietherapy station and the technic of treatment.

Then comes an investigation of the biologic action of telecurietherapy on both general conditions and on tissues or various malignant cells.

In conclusion, the authors deal with clinical considerations referring to indications of technic in different cases of neoplasms. They report a number of observations, to which they add the enumeration and results of all the cases treated in three years.

L M

Translation by HENRY BAYON, M D

PHOTOBIOLOGIE By LUDWIG PINCUSSEN, M D, Phil Direktor der Biolog-Chemischen Abteilung am Stadt, Krankenhaus am Urban, Berlin Pages, 543, illustrations, 101 Published by Georg Thieme, Leipzig, Germany, 1930 Price, 36 marks

logical results obtained by various investigators, both in pure research and from the standpoint of their application to disease conditions as well as the maintenance of normalcy, are presented in a systematic and comprehensive form. The volume will be of particular value to those interested in ultraviolet therapy.

The first portion of the volume deals with radiation and the laws of radiation, absorption spectra, fluorescence, the qualitative and quantitative determinations of radiant energy in sunlight, arc and spark spectra, photo-electric effects and physico-chemical changes produced by radiation. Nearly seventy pages are devoted to chemical effects such as isomerism, polymerization, oxidation, and reduction phenomena and photosynthesis.

The second part (over 300 pages) of the volume deals almost entirely with the biological effects of radiant energy, chiefly ultra-violet. The absorption of light by living organisms, the regulation of this absorption and the development of pigment, the influence of light on the growth of cells, micro-organisms, plants and animals, the effects on animal and plant metabolism, the influence of light on the nervous system, internal secretions, the blood, the skin and body temperatures, and the relations of light to the organ of sight are among the important topics which are considered and dealt with adequately but not in detail.

The text is replete with citations and adequate references are given. For instance, over 300 references constitute the bibliography of the chapter on the chemical effects of light. These references are to both foreign and American investigators and are brought down to the year 1930. The bibliography, in and of itself, is extremely valuable, as well as indicating the thorough acquaintance of the author with the field of photobiology. The book can be recommended to those who are desirous of possessing an up-to-date treatise on this subject.

This is an excellent compilation of facts and theories concerning the action of radiant energy (ultra-violet, visible and near infra-red) on animal and plant tissues. The fundamental physical principles and the bio-

¹This review, in French was published in *Bruxelles Medical* Oct. 4, 1931, XI 1438

SURGICAL PATHOLOGY OF THE DISEASES OF BONES By ARTHUR E HERTZLER, M D, Professor of Surgery, University of Kansas, and Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kansas Pages, 272, with 211 illustrations Published by J B Lippincott Company, Philadelphia, 1931

This volume is one of a series of surgical-pathological monographs, which the author has written or proposes to write. The publication is excellently illustrated with ample and clear-cut roentgen-ray reproductions and photomicrographs. The descriptions of the ordinary affections of the bones are well written and clear. For the use of the surgeon it is to be highly commended. The author makes no claim that it is for more advanced study of the diseases of bone. His claim that there was a need for a pathology of diseases of bones is true. He has filled this need for many.

The subject of bone tumors is well discussed. While the author does not adhere strictly to the classification of the Registry, his reasons for this are well taken. This particularly difficult subject leaves much to be desired in the literature, and the author has assembled the available knowledge in a comprehensive way.

The discussion of joint affections is not so satisfactory from the standpoint of one interested in these conditions. However, the book is on diseases of bones and it may have been the author's intention to pass over the subject of joints. In the discussion of tuberculosis, however, the statement that "there is even grave doubt whether or not the disease is ever primary in the synovial membrane," might lead to a considerable amount of discussion as the more modern conception of joint tuberculosis certainly does not subscribe to that statement.

As a guide to the pathology of the more common affections of bone we can recommend this volume.

EXPLORATION RADILOGIQUE DE L'APPAREIL RESPIRATOIRE By EMILE SERGENT, Professeur à la Faculté de Médecine de Paris, Member de l'Academie de Médecine, FRANCIS BORDET, Ancien Chef de Clinique de la Faculté de Médecine de Paris, and HENRI DURAND, Chef du laboratoire de la Clinique de la Charité. With the technical collaboration of J COUVREUX, Chef du laboratoire de Radiologie de la Clinique de la Charité. Published by Masson et Cie, Paris, 1931. Two volumes, 465 pages, with 639 illustrations including 580 radiographs. Price, 350 francs.

various clinical signs, symptoms, laboratory and autopsy findings and thus place the interpretation of the roentgenologic changes in respiratory conditions on a more logical foundation. While this work is purported to be an iconographic atlas, such a description does not do justice to the accompanying text in which the multiplicity of intrathoracic shadows has been analyzed in an amazingly practical manner. The text is also replete with such information as is accumulated only from years of experience.

The first part (33 pages) is concerned with the technic of the roentgenologic examination. It is quite brief, but covers the practical essentials. The novice will wish that this subject had been considered in more detail, but, as the book is written primarily by clinicians, from their viewpoint

This excellent pictorial atlas of the chest has been prepared by eminent clinicians of wide experience. It is their purpose to correlate the roentgenologic findings with the

this omission of technical roentgenologic details may be pardoned

The authors have analyzed the roentgenologic findings in a rather unique fashion, considering first the normal chest, later the fundamental pathologic changes, and lastly the more complex pathologic changes. The detailed description of the fundamental pathologic changes is most excellent, and the photographs of pathologic specimens add

much to the value of the many excellent roentgenograms. The section devoted to bronchial affections is unusually comprehensive and is supplemented by many lipiodol studies. The cuts, typography, and binding are of superlative quality.

This is undoubtedly one of the finest books on the subject available, and even the experienced radiologist will find it of great value.

King George Knights Dr Henry S Wellcome—Many friends and associates of Dr Henry S Wellcome in the United States will be gratified to learn that knighthood was conferred on him in King George's New Year honor list in recognition of his generous support of medical research. He is a native of Wisconsin and became a British subject by naturalization. He was graduated at the Philadelphia College of Pharmacy and Science. He is a Director of the Gorgas Memorial Institute of Tropical and Preventive Medicine Washington, which operates scientific laboratories at Panama for research work touching causes and prevention of tropical diseases.

In connection with the monumental sanitary work of General Gorgas in Panama, it is recalled that at one time an attempt was made



to cut down appropriations which would have seriously handicapped the progress of the work. The Secretary of War, the Hon. J. M. Dickinson, who knew of Dr. Wellcome's experience and interest in tropical research, asked him, while in Washington in 1910, to visit Panama and make a thorough, detailed inspection of the conditions and methods of operation in all sections of the Canal Zone and to submit an unbiased report based on his personal observations.

Dr. Wellcome is a life member of the American Pharmaceutical Association and has taken an active interest in its scientific work since the beginning of his membership in 1875. At the last annual meeting of the Association held in Miami, Florida, during July, 1931, he was elected Honorary President.

Dr. Wellcome has received world-wide recognition for his great service to science and medicine, for his interest in missionary enterprises, and for his personal work in medical research, the history of medicine, and for his archaeological and ethnological explorations and studies.

ABSTRACTS OF CURRENT LITERATURE

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J G Stephens, M D
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Jacob H Vastine, M D
E C Vogt, M D
W W Watkins, M D
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THE ABDOMEN

Methods of Orientation in the Diagnosis of an Acute Abdomen Alejandro I Pavlovsky Rev Med Cubana, October, 1931, XLII, 1228-1234

This article is meant particularly for the instruction of the practitioner who, in order to make a responsible diagnosis, is forced to depend almost entirely on the history and physical examination of the patient. It is an article of bedside diagnosis when the laboratory is either not available or the urgency of the case is such that there is no time for such examination.

The author goes into minute details of history-taking and does a thorough physical examination. He leaves all laboratory examinations as a last resort. It does not mean that he does not believe in laboratory examinations, but he wishes to impress the practitioner with the fact that a diagnosis may be made in the absence of laboratory tests.

The reason for which this author leaves X-ray examinations to the last is that it is difficult to obtain reliable plates in urgent cases. He does not leave out or overlook the importance of the X-ray. On the contrary, he emphasizes the value of this examination, when possible to make it. He cites such examples as cases of perforated peptic ulcers in which the presence of air in the peritoneal cavity will clinch the diagnosis.

A volvulus of the sigmoid colon and an ovarian cyst with a twisted pedicle give similar physical findings. By the use of a barium enema and the fluoroscope or X-ray films, a differentiation can be made. When the colon is filled the volvulus will show, but if it is an ovarian cyst, the colon will not show any irregularity but will be displaced upward and laterally. Thus, the author concludes by making the statement that X-ray examination is of inestimable value in many cases.

JOSEPH MALDONADO, M.D.

Exploration of the Abdomen by X-rays C W Prowd Canadian Med Assn Jour, October, 1931, XXV, 444-446

This is the ninth in the series of articles be-

ing published in the *Canadian Medical Association Journal*, contributed by the Canadian Radiological Society, and dealing with physiotherapy in all its aspects. In this paper, the author keeps in mind the object of the series to educate the general profession, and sums up very concisely the progress which abdominal diagnosis has made since the advent of the X-ray.

A generation ago there was no X-ray. Today it is the greatest single factor as a diagnostic aid in all abdominal conditions. Not one but all the abdominal organs may be visualized either directly or indirectly. Exploration by X-rays forestalls examination by all other methods. No other means affords the same accuracy and certainty. It may even exceed inspection by the surgeon. Pre-pathologic conditions and disease in its incipiency are detected, as in malfunction of the gall bladder, stomach, and bowels. It has an important bearing on early diagnosis, and will loom large as a factor in preventive medicine. There are many unsolved problems to be attacked, but the accomplishment of the past gives promise for the future. We know the relative frequency and location of esophageal lesions, benign or organic. Cardiospasm and cancer, especially of the cardiac end of the stomach, are confusing, but the borderline case vanishes as the examiner becomes more expert.

We have learned that the large stomach, with so-called dilatation and prolapse, is peculiar to and characteristic of the asthenic type, and that it means no more than a long nose or a big foot, provided that it functions properly. Not more than 15 per cent of all cases with stomach symptoms have organic lesions of the stomach or duodenum. Duodenal ulcer is five times as frequent as gastric ulcer, and gastric cancer twice as frequent as gastric ulcer. Two-thirds of all gastro-duodenal lesions are duodenal ulcers, while cancer of the duodenum is the rarest of all lesions.

The X-ray has questioned or confirmed the accuracy of many statistics. Thousands of cases give decided values. The prominence of certain diseases has been lost. The liver and colon are often proved double offenders, and

the innocent appendix relegated to a minor part

The liver and gall bladder are the frequent sites of disease Opaque dye, administered orally or intravenously, has been of striking value in estimating liver and gall-bladder function and disease Gall-bladder disease is the most frequent organic cause of dyspepsia, pain, and gastric symptoms It is the source of trouble in about 25 per cent of all cases, and represents a higher percentage than the combined lesions, organic and functional, of the stomach and duodenum The frequency of gall-bladder and colon disorders is more and more emphasized They are closely inter-dependent A constipated colon and a constipated gall bladder constitute dual and parallel conditions

The secrets of the small and large gut are still largely unexplored or misinterpreted No field offers more for research than the twenty-five feet of the small and large intestine They still hold many secrets and remain the dark continent of the abdomen, with their intricate uncharted coast lines

Roentgen data are invaluable to the urologist Definite data are given by combined pyelographic and roentgenographic study The new method of intravenous pyelography gives promise of much usefulness, especially as an aid to the regular pyelographic examination

The female pelvic organs are examined by lipiodol, with good diagnostic results

There still remain the spleen, pancreas, blood-vascular and muscle tissues to present problems for the future.

No field is too obscure, no effort too great, no problem too difficult for the realm of the X-ray Never has sacrifice been so great as in this new science There is need to-day of greater precaution and care, recreation and limited hours The future is big with promise, the past replete with accomplishment, the present a high hour of endeavor Men and material, medicine and physics, have worked together to solve and to throw light on the great unknown The closed abdomen is revealed in the new light of twentieth century science

(Abstractor's Note.—The abstractor reviews, with pleasure, such an article as this

one, contributed by Prowd, and hopes that this somewhat extended abstract will stimulate more of our brethren to extend their efforts in the education of the general profession in the scope and accomplishments of our specialty)

L J CARTER, MD

APPARATUS

A New Instrument for Measuring the Hardness of Roentgen Rays, Called "Durometer" S Strauss and H-Th Meyer Strahlentherapie, Oct 3, 1931, XLII, 343-350

The authors describe an instrument, designed by Schreus, which is based on the penetrometer of Christen It permits the determination of the half value layer of roentgen rays by means of a fluoroscopic screen and a calibrated wedge The percentage of error is said to be ± 5 per cent For details of the construction, see the original article

ERNST A POHLE, M D, Ph D

Purification of Radon J Bannon. Journal of Cancer Research Committee of University of Sydney, August, 1931, III, 86-89

The author has designed a simple, liquid-air, radon-purifying apparatus which is quick in action, gives very satisfactory purifications, and is safer than many other types It has been in use for fifteen months When radon is not being drawn off, mercury protects the stop-cock leading from the radium container so that the grease on the cock is not decomposed, frequent greasing being then unnecessary Although the design of the apparatus differs widely from the conventional pattern which was abandoned in favor of the present design, the methods employed are similar

For preparations of the order of 300 mc., a concentration of 12 mc of radon per cubic millimeter at a pressure of 25 cm of mercury may be obtained Thirty Muir seeds can be made in twelve minutes For details reference must be made to the original paper

J G STEPHENS, M D

Apparatus for the Sterile Catheterization

of the Bronchi Armando Dei Rossi
Minerva Med, Oct 6, 1930, XXI, 481, 482

The author has developed an aseptic sound to extract specimens of the tracheo-bronchial flora, free from the bacteria usually present in the upper part of the respiratory tract. It consists of a curved tube having at one end two small jaws which can be opened or closed at will from the outside. A catheter is introduced into it, and the whole instrument, with its jaws closed, is lowered into the trachea; from there, by opening the jaws, the catheter may be pushed into one of the large bronchi.

The instrument has special importance also in bronchography, because it permits direct injection of opaque media in the lower parts of the bronchial ramifications. An X-ray photograph shows well how near the end of the catheter is to the diaphragm. The author has found the instrument perfectly satisfactory in the examination of 150 patients.

L MARINELLI

A Simple Uroselectan Outfit O LeGrand Suggett Urol and Cutan Rev, October, 1931, XXXV, 666

The author has devised for the administration of uroselectan a simple gravity apparatus which enables one to mix, sterilize, and administer the drug with a single container. A 125 c c Ehrlemeyer flask, fitted with a rubber stopper penetrated by two pieces of glass tubing, is employed. One piece of the tubing is flush with the inside of the stopper, but protrudes an inch from the outside for attachment of the rubber tubing. The other piece is flush with the outside but long enough to come within half an inch of the top of the flask to permit the entrance of air. Three feet of tubing, with an adapter to fit a Schreiber or other intravenous needle, and a short section of glass tubing for a window near the distal end completes the apparatus. A clamp was found of great value by the author, for attaching the flask to either a horizontal or a vertical support.

J N ANE, M D

THE APPENDIX (DIAGNOSIS)

Roentgenologic Signs of Appendicitic Ab-

scusses Sigfrid Arnell Acta Radiologica, 1931, XII, 359-368

The author discusses the roentgen signs of appendicitis and especially those of appendiceal abscess. He feels that this phase of diagnosis has been neglected and deserves greater use in the examination of doubtful abdominal cases. No definitely direct roentgen findings are seen in uncomplicated appendicitis, but roentgen examination with or without the use of contrast medium is frequently helpful in showing lateral appendiceal abscess. He mentions the roentgen signs as described by Laurill and Westerborn (*Surg, Gynec and Obst*, 1931, LII, 804), these consisting of shadow of inflammatory process, haziness of renal contours, gas in abscess, appendiceal calculi, and contrast filling of fistulous tract and cavity.

M J GEYMAN, M.D.

Intussusception of the Appendix E W Mitchell Canadian Med Assn Jour, August, 1931, XXV, 194-196

This is a case report of a patient, Mrs P., married, aged 28, who was admitted to the Toronto General Hospital on March 28, 1931. There was no history of previous illness. Four days before admittance, at 6 p m, she began to have dull epigastric pain. During the night the pain became more severe, spasmodic, and colicky in nature, and was referred to the region of the umbilicus. The paroxysms of pain occurred about every two hours, were short in duration, and agonizing. After each paroxysm of pain she felt absolutely well. There was no vomiting and she had a normal bowel movement.

She continued at her occupation for three days following the onset. During this period the paroxysms of pain continued, were definitely colicky, referred across the abdomen at the level of the umbilicus, and recurred about every two hours.

On examination the patient did not appear ill. The abdomen was scaphoid, and there was no visible peristalsis or mass. There was tenderness, without rigidity, on the right side from McBurney's point to the costal margin. The rectal examination was negative and the temperature and pulse were normal. The

white blood count was 7,600 and the urinalysis was negative for sugar and albumin, microscopically, there were a few pus cells

She was admitted to the hospital, and a diagnosis of appendicitis was made. At operation the appendix could not be visualized, but at the junction of the *taenia coli* a depression could be seen into which the meso-appendix was traced. The appendix was felt as an elongated mass within the cecum. An attempt to reduce the intussuscepted appendix failed. The cecum was opened through and parallel to one of the longitudinal bands, the appendix was clamped at the base and removed. The opening in the cecum was closed and the wound closed in layers without drainage. The convalescence was uneventful.

A study of the literature shows that intussusception of the appendix is rare. At Mount Sinai Hospital, New York, in 5,000 operations for appendicitis, one case of intussusception of the appendix occurred, as reported by Moschkowitz. The author has been able to collect from the literature 70 cases, a few of which were probably not true intussusception.

The important points in the clinical history and examination are the colicky pain, with definite remissions, the absence of rigidity, mass, and vomiting. The early recognition and treatment would save the more serious complications of massive intussusception of the bowel.

L J CARTER, M D

Diagnostic Considerations Regarding Appendicitis, Chronic in Origin, and Gastric and Intestinal Manifestations M Trincas L'Ateneo Parmense (Suppl), 1931, III, 283-304

On the basis of 150 cases, which he studied in detail clinically and radiologically, the author discusses the disputed question of the reflex action of appendicitis of chronic origin. The results of his investigations are summed up in the form of percentages of the total number of cases as follows:

Classic cases of chronic origin, with pain in the appendicular site or located anomalously, and with phlogistic complications of various nature, 132, or 88 per cent

Forms prevailingly gastric, twelve, or 8 percent. These were equally divided between hypersthenic and hyposthenic.

Forms prevailingly intestinal, six, or 4 percent. Of these, forms with prandial diarrhea numbered two, with postprandial diarrhea three, and with spastic occlusion one.

W W WHITELOCK, Ph D

THE BLADDER

Leiomyoma of the Bladder With a Report of a Case and a Review of the Literature Herman L Kretschmer *Jour Urol*, October, 1931, XXVI, 575-589

A case of leiomyoma of the bladder in a young girl of nineteen is reported. The literature on this type of bladder tumor has been very well reviewed and is incorporated in the article. Frequency, etiology, age, sex, symptoms, diagnosis, treatment, and prognosis are considered. An extensive bibliography accompanies the paper. A cystogram is reproduced which demonstrates bilateral filling defects occupied by the tumor substance. Illustrations of the surgical specimen and photomicrographs of the author's case are also included.

DAVIS H PARDOLL, M D

A Case of Extroversion of the Urinary Bladder J S McEachern *Canadian Med Assn Jour*, September, 1931, XXV, 324

The mother of a female infant, aged 12 weeks, noticed a mass protruding from the vulva, while the child was crying hard. At 4 P M, the physician reduced the mass and sent the patient in for an examination. The mass recurred after a fit of crying while in the hospital. It was again reduced but the condition not diagnosed. Under an anesthetic the child was examined and the vagina and cervix appeared normal. The anesthetic was stopped and the child began to vomit. Slowly the urethral orifice was seen to dilate, and a mass was suddenly extruded from it. This mass quickly became a deep bluish black. Pressure between the finger and thumb flattened it out. Lifting it forward, the orifice of one ureter could be seen, the extroversion was easily reduced. The child was kept in bed with the

foot of the bed elevated for about a month There was no recurrence of the trouble Nine years later the patient was examined and nothing abnormal was found

The parents reported that for the first two years the child had no urinary control From that time on there was improvement in control and for the last three or four years it has been normal

L J CARTER, M D

BLOOD CHANGES

Influence of Roentgen Irradiation on the Sodium Content of the Blood Serum Karl Adler Strahlentherapie, Oct 24, 1931, XLII, 584-590

The influence of roentgen irradiation on the sodium content of blood serum was studied in rabbits and in patients In rabbits, which had received a surface dose of 1,000 r, the sodium content of the blood serum was decreased by from 6.54 to 15.4 per cent of the initial value Patients who were treated with the usual roentgen and radium doses showed no changes in the sodium content of the blood

ERNST A POHLE, M D, Ph D

The Influence of Roentgen Rays on the Alkali Reserve of the Blood Kurt Kading Strahlentherapie, Oct 24, 1931, XLII, 571-583

The alkali reserve of the blood is usually constant, but it can be influenced by a number of factors, for instance, disease, anesthesia, work, and irradiation The values usually move towards the acid side, while alkalosis was not observed by the author He found that in malignant tumors of the genital organs the alkali reserve is very low Following roentgen irradiation it increases in some and decreases in other patients Since only a small number of cases were studied, no definite conclusions could so far be drawn

ERNST A POHLE, M D, Ph D

BONE (DIAGNOSIS)

Fracture of the Iliac Bone, with Sinking of the Acetabulum and Intrapelvic Luxation

of the Femoral Head Alberto Fernández Saralegui La Semana Méd, Sept. 10, 1931, XXXVIII, 799-804

The author presents this case because of its rarity A man, 40 years of age, was struck by an automobile which was going at a low rate of speed The blow caused him to stagger forward, leaving the right leg in flexion and the left leg in extension While he was in this posture, the bumper of the car struck him on the external part of the left leg He immediately felt pain as if a bone had been broken His left leg remained in flexion and thus he was carried to the hospital

Attempts to correct the vicious position resulted in a reduction of the flexion On examination, the left leg was found in flexion, adduction, and internal rotation, with the left foot resting on the internal aspect of the right one and the left knee resting against the internal aspect of the right one In the left hip, there was noticed a flattening due to total disappearance of the prominence produced by the greater trochanter Measurements revealed a shortening of 5 cm as compared to the right extremity The Nélaton-Roser line was found in accordance with this shortening and so was the Shoemacker line The deformity of Bryant's triangle was found in relation to the displacement of the greater trochanter Rectal examination revealed the new position of the femoral head, with the piece of bone torn from the acetabulum in front of the femoral head Radiographs showed intrapelvic luxation of the femoral head, measurements showing that it had penetrated so deeply as to reduce the size of the pelvic cavity about one-third There was fracture of the antero-lateral segment of the iliac bone and also fracture of the lesser trochanter

The treatment was instant reduction, massage for four weeks, and walking exercises after eight weeks The results were good for that type of fracture

N G GONZALEZ, M D

BONE (THERAPY)

Avulsion of the Lesser Trochanter of the

Femur J S McEachern and H N Jennings Canadian Med Assn Jour, October, 1931, XXV, 449, 450

A healthy athletic boy, 16 years of age, was running to catch a street car. He slipped on some ice, caught his right foot in a rut, and saved himself from falling by a violent backward jerk of the body. There was immediately severe sharp pain in the right groin and the adjacent part of the thigh. After a few minutes he was able to walk to the street car, holding the right leg and hip stiff, and sliding the right foot along the ground.

X-ray examination showed the lesser trochanter of the right femur to be torn loose at the epiphyseal line and drawn upward and forward about 3 centimeters. The patient was put to bed and the right leg suspended in a bent Thomas splint, hung from a Balkan frame, with the hip flexed to 100 degrees. After the first day there was no pain. After four weeks in this position the leg was lowered by degrees, and in another week the patient was allowed to be up, with crutches. A second film taken at this time showed the epiphysis drawn back into partial contact with the diaphysis, about 2 cm from its proper position, and good bony union had apparently occurred.

The authors call attention to the fact that avulsion of the trochanter is a rare injury. They have been able to bring the number of reported cases up to forty-eight (*Note*—The abstractor has one case which he has not reported.)

Common symptoms are pain in the groin, inability to flex the thigh, and, usually, inability to walk.

L J CARTER, M D

BONE DISEASES (DIAGNOSIS)

Unusual Forms of Familial Osteochondrolystrophy T Dale Acta Radiologica, 1931, XII, 337-358

The author reports three cases of an unusual familial skeletal disease. They differ from chondrolystrophy in that the extremities are of normal length while the trunk is

abnormally short. The disproportion becomes more pronounced as age increases. The most marked osseous abnormalities occur in the spine and consist of defects in ossification, resulting in various degrees of kyphosis and scoliosis.

Marked irregularity of the upper femoral epiphysis occurred in all three cases. Similar changes were also seen in the proximal epiphyses of the humerus in two of the cases, and of the distal forearm epiphyses in the first and third cases. The author believes the etiology to be on an endocrine basis.

M J GEYMAN, M D

Diffuse Bone Endothelioma (Ewing) Julio Diez La Prensa Méd, Aug 30, 1931, XVIII, 396-414

The author presents here a good treatise on this subject, the purpose of which is to prove that such a tumor does exist. He follows the ideas of Ewing, Kolodny, and Connor. He gives a good review of the literature and presents photomicrographs and radiographs of the condition. Great praise is given to American investigators.

N G GONZALEZ, M D

Chronic Tuberculous Hygroma of the Deep Trochanteric Bursa Francesco Satta La Radiologia Medica, November, 1930, XVII, 1251

This article is a complete report of a patient suffering from hygroma of the trochanteric bursa. Radiologic examination disclosed not only the size of an extremely distended bursa, but also the diffusion of its contents to the surrounding tissues through the weaker points of its membrane.

L MARINELLI

Femoral Condylitis Report of Cases Merrill Coleman Mensor Calif and West Med, August, 1931, XXXV, 121, 122

The author reports two cases which he has designated as femoral condylitis. The history is that of sharp boring pains on the outer side of the knee. X-ray examination shows a small defect over the external condyle about two

millimeters in diameter, with a small calcified mass about the same size adjacent to it in the soft tissue. This has been diagnosed as a small avulsion fracture and as a chip fracture with periosteal tear. As far as history by repeated interrogation can determine, trauma is definitely excluded.

The X-ray findings of an apparent fracture are not explained. In this condition are found all the signs of acute inflammation. Because of the conflicting reports of the inflammatory signs and the X-ray appearance, the relation of this condition to industrial medicine is important, due to a medico-legal aspect.

FRANCIS B SHELDON, M D

The Diagnosis and Treatment of Acute Osteomyelitis in Children Grover C Penberthy Jour Michigan St Med Soc, June, 1931, XXX, 424-428

The X-ray findings in the acute stage are of little value, at the end of four or five days, irregularities and changes in density may be made out. The history and clinical findings should be given to the roentgenologist to assist in the interpretation of the X-ray appearances. The best possible technic of obtaining bone detail must be used, and the examination should include the opposite limb for comparison. The age of the patient and the duration of the disease are factors which enter into the technic.

W W WATKINS M D

Leprotic or Tuberculous Arthritis? Francesco Satta La Radiologia Medica, December, 1930, XVII, 1395-1398

The author has found an osteo-arthritis process under the astragalus, with phenomena of rarefaction and reabsorption on one side and osteoperiostitis on the other. The patient was affected with lepra tuberosa florida, although the general appearance of the lesion suggested that it was of tuberculous nature.

L MARINELLI

Malignant Osteoclastoma J W Orr Jour Path and Bacteriol, March, 1931, XXXIV, 265, 266

A case is reported in which sections from

the lungs of a museum specimen showed metastatic tumor nodules containing numerous giant cells of the osteoclastic type.

Subsequent investigation elicited that the patient had had the right leg amputated for a growth of the lower end of the femur. The microscopic diagnosis at the time of amputation was "myeloid sarcoma".

Note "Myeloid sarcoma" or "osteoclastoma" are the terms used in England for what in America is known as benign giant-cell tumor of the bone.

E C VOGT, M D

Kohler's Disease in the Third Metatarsal Bone Giuseppe Grado Archivio di Radiologia, May-June, 1931, VII, 557-569

According to the author, in the statistical review of Cahen-Brach, based on sixty-three cases in the literature, in only five was there involvement of the third metatarsal. His case, a boy of ten, had a characteristic lesion in the third metatarsal and the base of the phalanx with which it articulates.

E T LEDDY, M D

BONE DISEASES (THERAPY)

Metastasis of the "Benign" Giant-Cell Tumor of Bone (Osteoclastoma) S C Dyke Jour Path and Bacteriol, March, 1931, XXXIV, 259-263

The author reports a case of benign giant-cell tumor arising from the lower end of the femur, with metastases in the scalp, lungs, kidneys, ribs, spine, and mediastinal and peritoneal lymph nodes.

The patient was a male, 25 years of age, and the history extended over five years. He had been treated with Coley's fluid, but amputation was eventually resorted to.

The author was able to find recorded only one other case of this type of tumor, with metastases, the authenticity of which could not be questioned.

E C VOGT, M D

CANCER (DIAGNOSIS)

The Biopsy Question Benjamin G P Shafiroff Am Med, November, 1931, XXXVII, 605-608

The author discusses the importance of a biopsy in all lesions in which malignancy is suspected. A biopsy is believed to serve the following functions: To make a differential diagnosis, to aid in outlining the method of treatment, to determine prognosis, and to assist in research of the disease.

The treatment of malignancy varies with the type of pathology present. Surgery, X-rays, radium, or various combinations of these agents are employed, depending upon the condition present. In like manner, the highly malignant types of cancer require more radical treatment than the simple benign tumors. Of great importance before biopsy, however, is preliminary X-ray irradiation of the involved region to prevent direct extension and metastasis through the lymphatics. In certain lesions, such as carcinoma of the breast, all preparations should be made for immediate surgery in the event that the pathologist finds a malignant process.

Lesions of the cervical glands yield important information on biopsy analysis. Diagnosis of tumors of the face and extremities should be corroborated by biopsy. Biopsy is not as valuable in intra-abdominal and intrathoracic lesions, for the X-ray and bronchoscopic examinations reveal valuable information. The author believes that the portion of tissue removed for biopsy should be taken from the periphery of the tumor and should contain healthy tissue as well as the tumor tissue. A negative biopsy report may not mean that the lesion is not malignant, but a positive biopsy is always significant.

J N ANÉ, M D

Cancer of the Thyroid Its Radiosensitivity Cushman D Haagensen Am Jour Cancer (Suppl), July, 1931, XV, 2063-2105

The author studied thirty cases of carcinoma of the thyroid which had received radiation. He found considerable variation in response; these tumors by no means follow the usual laws of radiosensitivity, particularly

from the viewpoint of primary regression and definitive cure.

The various forms of thyroid cancer were grouped into five types, each type having a fairly characteristic natural history and morphologic structure.

The author finds that there is a moderate radiosensitivity in the less anaplastic types, particularly the adeno-carcinoma group. The most rapidly growing and anaplastic types appear to be uniformly radioresistant.

Emphasis is placed on the histologic structure of the tumor as well as size and extent in determining the type of treatment.

JOHN R. CARTY, M D

A Study of Cancer in Ex-service Men. Philip B Matz Med Bull Veterans' Administration, November, 1931, VII, 1010-1031

In a thorough and complete study, the author analyzed 319 cases of malignant diseases which occurred in patients in government hospitals. Of this number, 317 were males and two were females. The series consisted of the following: 259, or 81.2 per cent, carcinomas, 49, or 15.4 per cent, sarcomas, one glioma, two teratomas, and three unclassified tumors.

Since the work of Maud Slye and the studies of Warthin support the opinion that heredity is an etiologic factor in malignant neoplasms, the author studied a smaller group of 52 cases of malignant tumors with a positive hereditary or familial history, or both. It was noted that 69.2 per cent gave an hereditary history of cancer, 21.2 per cent gave a familial history, and 9.6 per cent gave both a familial and hereditary history of cancer.

The most frequent locations of the tumors in this group were: The skin, lip, stomach, lymph nodes, rectum, buccal cavity, and bladder. It likewise was noted as a result of this study that the age period from 35 to 40 was the most critical one for the onset and incidence of malignant disease. No indication of a relationship existing between the type of occupation and cancer of a particular organ or site was observed, except in the group of 48 cases of cancer of the skin or mucous m-

branes In this group it was found that in 25 instances the patients were farmers or ranchers and thus exposed to the actinic rays and outdoor life of their occupations However, of interest is the fact that 128, or 40 per cent, of the 319 cases of malignant disease gave a well defined history of previous irritation or inflammation In the author's opinion, in 76 instances the malignant tumors might be attributable to smoking

In reviewing the clinical records of the series of 319 cases it was found that 88, or 27.6 per cent, gave a history of having had some precancerous condition prior to the actual development of cancer The most frequent early symptoms and signs of malignant disease noted were Tumor formation, pain, ulceration, bleeding, and loss of weight The characteristics of malignant neoplasms were arranged by the author, in their order of frequency, as follows Induration and ulceration, induration, ulceration, tumor formation and induration The rate of growth of the malignant tumors was slow in 62.7 per cent of cases and rapid in 36.1 per cent of the series

The diagnostic methods employed in these cases naturally depended to a large extent upon the organ affected Clinical means and biopsy, therefore, were the most frequent procedures employed in 134 cases of cancer of the skin, mucous membranes, and buccal cavity Clinical means, the X-ray, and exploratory operation were the diagnostic methods employed in 79 cases of cancer of the digestive tract and in ten cases of malignant tumors of bone Likewise, it is of interest that 46 per cent gave a definite history of pain at the onset of the growth, 29.3 per cent developed pain after the onset of the growth, and 24.7 per cent had no pain at any time during the course of the disease

Since the results obtained in the treatment of cancer are in large part dependent upon the early diagnosis and treatment of the disease, the author considered it of importance to study the period of time which intervened between the onset of the malignant process and its recognition and diagnosis In this regard it was noted that 201 patients were treated for various conditions before a diagnosis of malignant tumor was made Of the

201 cases, 105 were treated for periods less than one year and 25 from one to two years In some instances patients were treated as long as twenty years before a diagnosis of cancer was definitely made

Of 319 patients, 112 gave evidence of metastases In a study of the sites of metastases it was found that in the case of carcinoma the sites in the order of frequency were Lymph nodes, liver, lungs, spleen, pancreas, peritoneum, and bones In the case of sarcoma the sites of metastases in the order of frequency were Lymph nodes, lungs, liver, general sarcomatosis, kidney, spleen, ileum, and bones

J N ANÉ, MD

Primary Cancer of the Ovary, with Invasion of the Peritoneum and Pleura Uterine Fibroma Temistocles Castellano and Severo R Amuchástegui La Prensa Méd, Aug 30, 1931, XVIII, 389-396

A woman, 50 years of age, was admitted to the hospital She had been normal until she married, when she developed menstrual disturbances, such as pain, menorrhagia, and metrorrhagia These gradually became worse as she grew older The menopause came on at the age of 47 years Seven months prior to admission, she complained of diffuse pain and heaviness in the abdomen The abdomen seemed to increase in size, there was edema of the inferior extremities, accompanied by weakness and dyspnea She consulted a physician who tapped her, obtained ten quarts of fluid, and advised her to enter the hospital

In the hospital, after being tapped, she was found to have an irregular, hard mass in the epigastrium, extending from the ribs to the umbilicus In the hypogastrum, there was palpated another mass which extended from the umbilicus to the symphysis pubis Still other masses could be felt in the abdomen Radiograms of the chest revealed invasion of the pleura on the right side Biopsy of the abdominal tumor showed malignancy Necropsy findings were a primary tumor of the ovary, with invasion of the peritoneum and pleura, and a uterine fibroma

N G GONZALEZ, MD

CANCER (DIAGNOSIS)

The Biopsy Question Benjamin G P Shafiroff Am Med, November, 1931, XXXVII, 605-608

The author discusses the importance of a biopsy in all lesions in which malignancy is suspected. A biopsy is believed to serve the following functions: To make a differential diagnosis, to aid in outlining the method of treatment, to determine prognosis, and to assist in research of the disease.

The treatment of malignancy varies with the type of pathology present. Surgery, X-rays, radium, or various combinations of these agents are employed, depending upon the condition present. In like manner, the highly malignant types of cancer require more radical treatment than the simple benign tumors. Of great importance before biopsy, however, is preliminary X-ray irradiation of the involved region to prevent direct extension and metastasis through the lymphatics. In certain lesions, such as carcinoma of the breast, all preparations should be made for immediate surgery in the event that the pathologist finds a malignant process.

Lesions of the cervical glands yield important information on biopsy analysis. Diagnosis of tumors of the face and extremities should be corroborated by biopsy. Biopsy is not as valuable in intra-abdominal and intrathoracic lesions, for the X-ray and bronchoscopic examinations reveal valuable information. The author believes that the portion of tissue removed for biopsy should be taken from the periphery of the tumor and should contain healthy tissue as well as the tumor tissue. A negative biopsy report may not mean that the lesion is not malignant, but a positive biopsy is always significant.

J N ANE, MD

Cancer of the Thyroid Its Radiosensitivity Cushman D Haagensen Am Jour Cancer (Suppl), July, 1931, XV, 2063-2105

The author studied thirty cases of carcinoma of the thyroid which had received radiation. He found considerable variation in response, these tumors by no means following the usual laws of radiosensitivity, particularly

from the viewpoint of primary regression and definitive cure.

The various forms of thyroid cancer were grouped into five types, each type having a fairly characteristic natural history and morphologic structure.

The author finds that there is a moderate radiosensitivity in the less anaplastic types, particularly the adeno-carcinoma group. The most rapidly growing and anaplastic types appear to be uniformly radioresistant.

Emphasis is placed on the histologic structure of the tumor as well as size and extent in determining the type of treatment.

JOHN R CARTY, MD

A Study of Cancer in Ex-service Men Philip B Matz Med Bull Veterans' Administration, November, 1931, VII, 1010-1031

In a thorough and complete study, the author analyzed 319 cases of malignant diseases which occurred in patients in government hospitals. Of this number, 317 were males and two were females. The series consisted of the following: 259, or 81.2 per cent, carcinomas, 49, or 15.4 per cent, sarcomas, one glioma, two teratomas, and three unclassified tumors.

Since the work of Maud Slye and the studies of Warthin support the opinion that heredity is an etiologic factor in malignant neoplasms, the author studied a smaller group of 52 cases of malignant tumors with a positive hereditary or familial history, or both. It was noted that 69.2 per cent gave an hereditary history of cancer, 21.2 per cent gave a familial history, and 9.6 per cent gave both a familial and hereditary history of cancer.

The most frequent locations of the tumors in this group were: The skin, lip, stomach, lymph nodes, rectum, buccal cavity, and bladder. It likewise was noted as a result of this study that the age period from 35 to 40 was the most critical one for the onset and incidence of malignant disease. No indication of a relationship existing between the type of occupation and cancer of a particular organ or site was observed, except in the group of 48 cases of cancer of the skin or mucous mem-

breast with post-operative and without post-operative radiation, has convinced us that (1) the average natural duration of life for a patient with carcinoma of the breast is three years, (2) as a result of radical operation about 38 per cent of the cases will be free from disease for the natural duration of 1½ and about 30 per cent for five years, (3) with repeated superficial doses of radiation, at least ten per cent more patients may be expected to survive the five-year period"

W W WATKINS MD

Carcinoma of the Cervix, with Twin Pregnancy and Normal Delivery J L Blonstein *Lancet*, Oct 24, 1931, CCXXI, 903, 904

The author was called in on an obstetrical case by a midwife because of prolonged first stage. There was very little progress during the next twenty-four hours, but the patient was delivered of a female child followed by a male child three hours later. There was no difficulty in delivery. The male infant developed pemphigus neonatorum on the fifth day and died on the eighth day. The female infant developed a similar condition on the sixth day and died on the ninth day. The mother had a normal postpartum convalescence until the thirteenth day. She had been allowed up on the tenth day. On the fourteenth day she developed pulmonary edema, became comatose, and died. Postmortem examination showed carcinoma of the cervix.

The author reports this case because of the following interesting points. The absence of any symptoms of carcinoma during the pregnancy, the absence of severe postpartum hemorrhage, the viability of the infants, and the probable infection of the infants with pemphigus from the carcinomatous area.

F L GRANDSTAFF, MD

Carcinoma of the Bladder with Vesicorectal Fistula Robert Pollock Urol and Cutan Rev., September, 1931, XXXV, 584-587

Tumors of the bladder, which are more common in males, occur during the period

from the fourth to seventh decades, and are found most frequently at or about the ureteral orifices and bladder outlet. The author believes that a papillary carcinoma frequently begins as a benign papilloma.

The initial symptom of an early carcinoma is generally painless hematuria, due to the following causes. Breaking up of papilla, ulceration and necrosis, instrumentation. The later symptoms are those due to infection, and those which result from obstruction at or near the bladder neck. In advanced stages pain is important, being caused by nerve involvement.

While the diagnosis may be suspected from the history, a careful physical, cystoscopic, and roentgenologic examination should be made. A rectal examination in males, or vaginal and rectal in females, may prove very valuable. Cystoscopy permits the operator to visualize the tumor mass and a cystogram gives information regarding the degree of involvement and extent. Routine X-ray studies of the pelvis, long bones, chest, and skull should also be made.

The author divides the treatment of carcinoma of the bladder into the following procedures: (1) Surgery, (2) high frequency electric treatment, (3) radiation with X-ray or radium, and (4) combinations of these methods.

The case of a male, 67 years of age, who was admitted to the hospital complaining of painless hematuria, is reported. Six months previous to admission a prostatectomy had been performed. Cystoscopy revealed a diffuse redness of the bladder mucosa, with thickening and loss of luster. Finger-like projections from the bladder neck and posterior urethra were seen. Cystography showed a constricted bladder with partial filling of the left ureter. Rectal examination revealed two firm masses occupying the prostatic bed. Radium was implanted into the prostatic bed and the patient was given transfusions and a course of deep X-ray treatments.

The patient was subsequently admitted for a third time, complaining of hematuria, frequency, pyuria, dysuria, and nocturia. Rectal examination at this time revealed a firm irregular mass filling the prostatic cavity. Blood

A Cancer Program for California Lyell C Kinney Calif and West Med, May, 1931, XXXIV, 321-325

The author gives some statistics regarding the increasing rate of cancer and its mortality and believes that the responsibility of the medical profession is greatly increased, due to the fact that the public is becoming cancer-conscious. The cure depends upon early diagnosis and immediate treatment. Most cancer is seen by the general practitioner first, and treatment most often is given by surgeons, whose experience may be limited to a very few cancer patients per year. One of the present problems of the profession is the accomplishment of early adequate treatment by skilled and experienced persons.

The author then notes the preventative measures of cancer by irradiation of the areas of irritation. He believes that the high mortality is due to the fact that most persons do not seek medical advice immediately. Not only must there be early diagnosis, but adequate treatment must be instituted at once, because the curable stage of cancer is very short. Once this time is passed the patient cannot be returned to a stage of curability. In the later stages palliation should be used with skill so as to make the patient more comfortable and to prolong life. Another problem is the education of the family physician to protect his patients from cancer by the treatment of precancerous lesions.

Since the diagnosis involves many technical procedures, and the program of therapy takes the judgment of an internist, a surgeon, a pathologist, and a radiologist, he believes there should be an institution for training and assistance in the diagnosis and treatment of cancer by the general practitioner. Such an institution should also carry out cancer research. The public should be taught that only in early recognition and immediate destruction of the growth lies the hope of cure of cancer.

FRANCIS B SHELDON, MD

Carcinoma of the Lungs Joseph Rothman Med Bull Veterans' Administration, November, 1931, VII, 1044-1047

Primary carcinoma of the lungs is believed

to occur less frequently than the secondary type. MacMahon and Carman collected the records of 482 authentic primary carcinomas of the lungs. Ewing classifies pulmonary carcinoma as follows: (1) Carcinoma arising from the bronchial epithelium, usually of the squamous or cylindrical cell variety; (2) bronchial carcinoma from the mucous glands, found as nodular areas, usually smaller than the other types and located on the walls of the lower end of the trachea or the upper bronchi; (3) carcinoma from the pulmonary alveoli, usually of the cuboid or cylindrical cell variety.

While little is known regarding the etiology of primary carcinoma of the lungs, many authors believe that it is found in old cases of pulmonary tuberculosis. Secondary carcinoma represents the metastatic involvement of the lungs from a primary malignant focus elsewhere. The symptomatology in this condition depends on the location, variety, and condition of development. The differential diagnosis between pulmonary carcinoma and pulmonary tuberculosis is rather difficult in some cases.

J N ANÉ, MD

An Analysis of 1,347 Cases of Malignant Tumors of the Breast, with Special Reference to Management and End-results G W Crile The Journal-Lancet, Feb 1, 1931, LI, 99

Of the cases studied there were 523 available for end-result data, of these 284 (54.3 per cent) showed survival from three to five years, 196 (37.4 per cent) showed survival from five to ten years. With regard to radiation the author states, "Our radiotherapy department, under Dr U V Portmann, and our surgical division are agreed on the following conclusions: our experience testifies against radiation before operation. A course of radiotherapy takes time—usually at least two weeks. Radiation of itself alone cannot entirely cure a case of carcinoma of the breast as securely as a complete surgical excision. As for post-operative radiation, Portmann, by an extensive statistical study of the comparative results of operations for cancer of the

The Diagnosis of Cancer by Spectro-photometry Editorial Canadian Med Assn Jour, September, 1931, XXV, 326, 327

It has long been known that the blood serum of cancer subjects presents biochemical and biophysical peculiarities, as compared with normal serum. The hope has been that it would eventually be possible to devise a reliable specific test for the presence of cancer, based on such peculiarities. This hope has not been realized, but sufficient success has been obtained to warrant a continuation of the quest.

The editor summarizes the work that has already been done along this line, and calls attention to the recent important research of S G T Bendien, of Zeist, Holland, which is attracting much attention at the present time. His technic is as follows:

The serum to be tested is flocculated by various mixtures of acetic acid and sodium vanadate, and the precipitate so obtained is dissolved in a 2 per cent solution of sodium bicarbonate. This solution is then subjected to spectro-photometric analysis. From a series of spectrograms the extinction coefficients are obtained, and from these a curve is plotted on which the diagnosis is based. Bendien does not claim that he can make an accurate diagnosis in every case of cancer, but he does say that a positive reaction is never found in any other disease.

In the light of these findings, Bendien holds to the view that cancer is a local disease which can develop only if a specific abnormality of the serum be present. Should this prove to be true, the implications are far-reaching. Not only may it be possible to diagnose cancer in the early stages but even before it has developed. In other words, it may be possible to detect the predisposition to cancer. Furthermore, it may be possible to determine more fully the biochemical and biophysical derangements that accompany and characterize the cancerous process, which, indeed, may prove to be the cause of cancer. This, at the moment, seems to be mere speculation. Yet, the studies of other workers point in the same direction. The experiments of Maud Slye, in which she was able to produce in animals a

susceptibility of such high degree that 100 per cent developed cancer after the application of a simple irritant, are to the point here. Also, the experimental production of cancer by painting a skin surface with tar has shown that in it there are certain substances that have specific properties, for not every kind of tar will produce cancer.

Bendien's method has been subjected to rigorous test at the instance of the British Empire Cancer Campaign, as recorded by the *British Medical Journal*. Alfred Piney, Secretary of the Investigation Committee of this organization, went to Holland, taking with him thirty-eight tubes of blood serum collected from patients suffering from various diseases. Bendien examined twenty-one of the specimens and of these he diagnosed five as from cancer patients, all of which were correct. The British Empire Cancer Campaign Committee is satisfied that a distinct advance in the diagnosis has been made. Of course, time must be allowed before these findings can be properly appraised. Much more work must be done and by observers in other lands as well. The investigation is being started immediately at the Cancer Hospital in London.

L J CARTER, MD

CANCER (THERAPY)

The Position of Surgery and Radium in the Treatment of Oral Cancer Earl C Padgett Jour Kansas Med Soc, May, 1931, XXXII, 167-172

He who presumes to treat cancer should have a well balanced combination of pathologic, radiologic, and surgical knowledge and should be in a position to use all three. Epidermoid carcinoma in and about the face, mouth, and jaws has a fair prognosis when all phases of the picture are taken, and sound methods of attack used. The end-results depend on the completeness of the eradication of the local lesion and the tributary lymphatic areas. When bone is involved, radium does not effect a cure unless necrosis is produced so that as a rule excision becomes obligatory. Radium will not destroy the metastatic lesions of epidermoid carcinoma. The best methods

examination showed a leukocytosis. In order to ascertain the degree of rectal involvement a barium enema was given and roentgenograms showed visualization of the bladder, right ureter, and kidney pelvis, besides outlining the rectum. The sigmoid appeared irregular and moth-eaten. Pyelography, with intravenous uroselectan, showed faintly outlined pelvis and ureters, as well as bladder and rectum.

J N ANÉ, MD

Exeresis of Carcinoma of the Rectum
Victor Pauchet Rev Medicina y Cirugia,
Habana, Sept 30, 1931, XXXVI, 639-644

The purpose of this paper is to emphasize the necessity of a rectal or proctoscopic examination and to rule out cancer of the rectum as a possible diagnosis in patients complaining of disturbances in defecation, blood in the stools, and a burning sensation in the rectum. Many cases become inoperable because physicians have passed them for cases of hemorrhoids or enteritis. The author goes into detail to show that there could be more operable cases if diagnosis were made early, and that the mortality in those cases is not as high as expected. He advocates the use of radium in inoperable cancer situated low in the rectum and X-ray in those higher up.

N G GONZALEZ, MD

Cancer of the Lung Antony J Greco and
Edwin J Kehoe Med Bull Veterans' Ad-
ministration, September, 1931, VII, 876-883

In 1810, Bayle described the rarest type of pulmonary tuberculosis and this report was considered by Menetrier as the first recorded case of cancer of the lung. Subsequently, other investigators confirmed Bayle's observation that pulmonary tuberculosis is frequently found associated with carcinoma of the lung. It is believed that the incidence of cancer of the lung has increased in recent years, due to the increase in respiratory irritants, which is believed to play some part in the etiology of this condition.

No characteristic symptoms or signs are observed in cancer of the lung. While cough, foul expectoration, hemoptysis, pain, dyspnea,

fever, and cachexia are the outstanding symptoms, the symptomatology depends upon the location of the carcinoma and pressure upon the superior vena cava, the aorta, the heart, the recurrent laryngeal nerves, cervical sympathetic ganglia, trachea, or bronchi. Stivelman has recently shown that the lesion is most frequently found by lung specialists and correctly diagnosed by the X-ray.

It is agreed that the outcome is uniformly fatal in from two months to two years. Treatment is symptomatic, and Jackson believes that X-ray therapy is of palliative value and that this form of treatment causes shrinkage of the tumor and may prolong life for from four to five years.

The authors report a case of primary carcinoma of the lung, which was diagnosed during life, the patient living seventeen months. They also report a case of metastatic sarcoma of the lung, in which case the patient lived only ten weeks after the diagnosis was made.

The primary neoplasm of the lung occurred in a white male, 53 years of age, whose occupation was the oiling and greasing of automobiles. He gave a history of smoking a pipe, cigars, and many cigarettes, but the use of alcohol was denied. The family history was negative for any familial diseases or tendencies. He believed the onset of his illness occurred with fever, chills, cough, and pain in the chest. X-ray examination revealed the following findings: a homogeneous mass occupying the medial two-thirds of the left upper lobe, thickened pleura over the left upper lobe, scattered small densities at the left base, left diaphragm elevated, with a paradoxical movement suggestive of phrenic paralysis. Deep X-ray therapy was immediately ordered and the patient received many complete courses. While he constantly complained of loss of strength, putrid expectoration, and pain, his general condition remained good with no loss of weight for a considerable period. X-ray examination made the day before the patient died showed cavitation in the center of the mass, disseminated infiltration of the right lung, and the vertebral column convexly pushed toward the right side.

J N ANÉ MD

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L J CARTER, M D

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of treatment of the individual case should be chosen when the cellular characteristics, the probable irradiation response, and the chances for cure by excision methods are all considered

W W WATKINS, M D

**Carcinoma of the Mucosa of the Cheek
Radiation Treatment and Clinical Reports**
Luigi DeVecchi. La Radiologia Medica, December, 1930, XVII, 1399-1432

This article is an extensive clinical report of twenty-eight cases of carcinoma of the mucosa of the cheek observed by the author at the Institute of Radiology of the University and at the Cancer Institute of Milan. He favors radium therapy for the primary lesions of the mucosa and surgical intervention for metastatic adenopathies

L MARINELLI

Radiotherapy in Cancer of the Upper Air Passages W Douglas Harmer Lancet, Nov 14, 1931, CCXXI, 1057-1063

The author circularized a letter to all leading laryngologists and to many prominent clinics, and received seventy replies, the majority of these making it quite clear that radiation treatment had been of little value to them. He thinks that their opinions are due to improper management of the cases and stresses the importance of early diagnosis and treatment by radiation specialists

After X-ray treatment the following post-irradiation changes are noted. Total disappearance of the growth, fibrosis or partial healing, edema, X-ray sores, necrosis, pain, and mortality. There is a short discussion under each heading.

The author discusses the operable, the borderline, and the inoperable groups of malignant tumors of the larynx, the hypopharynx, the nose, nasopharynx, tonsil and mesopharynx, palate, and cheek. Endothelioma and transitional-cell carcinomas and lymphoepitheliomas are treated separately, giving their most common site of appearance.

The author, after reviewing the collected cases of carcinomas, sarcomas, and endotheliomas,

believes there is a great future for radiotherapy if treatment is properly handled. The authorities should prevent agencies from loaning radium to anyone except a recognized expert, and the patient ought not to be handed over to the pure radiotherapist who has no clinical knowledge of the disease that requires treatment. Great palliative relief can be afforded by X-ray treatment to a large percentage of advanced cases of cancer, and it is safer to treat the virulent types of cancer with X-rays rather than with surgery alone.

F L GRANDSTAFF, M D

A Method of Palliative Treatment of Carcinoma of the Esophagus D W Gordon Murray Canadian Med Assn. Jour, September, 1931, XXV, 271-275

Carcinoma of the thoracic esophagus has baffled all attempts at cure, except in a very small number of cases. Treatment by operation has but very few successful reports. Radium and X-ray therapy have been ineffective, partly because of the inaccessibility, and partly because of the common type of growth which is resistant to radiation. Quite massive growths, indicating a fairly late condition, exist in the esophagus without causing marked symptoms. Again, patients with obstruction to swallowing usually carry on with any form of food that will go through. Only when fluids cause difficulty do they seek relief.

All these conditions compose a picture of late malignant disease in an organ that is almost inaccessible, the treatment of which has vexed the medical profession for centuries. Gastrostomy or enterostomy to prevent starvation has been the method of choice in the past, but some have used various methods of intermittent dilatation. Neither of these procedures has been satisfactory even as a palliative.

Consideration of these facts led to a method of treatment for palliative purposes, of the principles of which Simmonds and, later, Souttar, were the first exponents. The aim is to dilate the stricture and pass through its lumen a tube which will prevent closure by spasm or growth. This allows the passage of food in the diet provided it is first

so sustaining the strength of the patient. It also eliminates the symptoms of obstruction and regurgitation of mucus, and precludes the method of feeding by gastrostomy, which prevents the patient from following most occupations and shuts him out from society generally. These benefits give the patient a different attitude towards life and relief from apprehension for the future.

Details of the operation of passing the tube, after dilating the stricture, through the esophagoscope, are given.

In the growths about the level of the bifurcation of the trachea, which comprise about 60 per cent of all esophageal carcinomas, this method may be used in practically all. In the lower part of the esophagus, comprising about 30 per cent, the growths tend to be more vascular and softer in consistency, with a greater tendency for the tube to drop through. Again those at the cardiac end are of the same type, but here one added objection is that the stomach contents regurgitate through the patent cardiac orifice, requiring these patients to be nursed in Fowler's position. Hypopharyngeal and post-cricoid growths are unsuitable.

The contra-indications to this method are advanced constitutional disease, so advanced as to preclude the giving of ether anesthesia, local conditions such as aneurysm of the aorta and tracheo-esophageal fistula, and osteo-arthritis of the cervical region, making full extension of the head impossible.

Ten interesting case reports are appended to the author's discussion. The patients all secured relief from symptoms, namely, obstruction to swallowing and mucus in the throat, for periods up to ten months. All of them, except one, were able to follow their usual occupation. Some were alive at the end of the interval reported, some had died from metastasis elsewhere, some from hemorrhage, and some from other diseases. In no case did the postmortem examination reveal any ulceration caused by the tube.

L J CARTER, M D

Remote Results of Treatment of Cancer of the Rectum Roger Savignac Arch d

mal de l'app digestif, June, 1931, XXI, 710-722

Seventy-three cases are followed and the author's general impression concerning treatment is given. Deep radiotherapy is considered useless and at times dangerous, while the use of radium is useful, especially in inoperable cases or cases refusing operation. Following its application the growth often recedes, and the pain and discharge lessen.

Functional disturbances usually occur for two or three years before the patient seeks relief and then he is likely to die about six months later. Colostomy should be reserved for inoperable cases when defecation becomes painful, tenseness occurs, the discharge increases, and the general condition becomes bad, since this procedure is of no help except when danger of obstruction occurs as indicated above. It should be done if radium therapy is needed, as it can best be applied through the colostomy. The immediate mortality is 30 per cent, among cases not operated upon, 40 per cent. Of the group reported, seven out of twenty-six survived, five of the seven living more than five years—one for nine years and two are still alive after ten years. There is but one chance in three to survive. The results justify the risk on the following conditions: (1) Selection of operable cases on the basis of their ability to resist the extreme shock, (2) age, (3) condition of other organs and general constitution, (4) absence of metastasis, (5) size, location, and mobility of the tumor through rectal manual and proctoscopic examination, and (6) preparation of the patient.

B J DE LAUREAL, M D

Irradiation of Carcinoma of the Cervix Uteri Harry H Bowing and Robert E Fricke Minnesota Med, March, 1931, XIV, 237-244

The results of radiation are fairly constant throughout the world, though the diversity of methods of treatment is surprising. The authors review the methods employed in the following clinics: Regaud's, where continuous irradiation over long periods of time is the distinguishing characteristic, and where,

in a total of 350 patients, 70 per cent of five-year cures were obtained, clinic of Forssell and Heyman in Stockholm, Wintz in Erlangen, who uses roentgen irradiation entirely, Doderlein Clinic in Munich, where combined radium and X-ray are used, at Zurich, where Furst advocates roentgen treatment followed by radical hysterectomy, Radium Institute of Brussels, Baltimore, where Kelly and Burnam give massive doses in one treatment, University Hospital in Philadelphia, Memorial Hospital in New York, Woman's Hospital in New York, Schmitz of Chicago, Huntington Memorial Hospital in Boston, Schreiner of Buffalo, Pomeroy of Cleveland.

The technic at the Mayo Clinic is described, being similar to that many times described by these authors in various publications, their five-year results in cases treated between 1915 and 1924 were published in the March, 1930, issue of *Minnesota Medicine*. The Mayo Clinic method lies between the massive dose and the fractional dose, embodying some of the advantages of each.

W W WATKINS, M D

The Massive Dose and Fractional Methods in Radiation Therapy of Cancer
Leopold Freund *Acta Radiologica*, 1931, XII,
315-336

The author presents a thorough and very interesting history of the development of radiation therapy since 1896. He finds proof of its merit in the fact that it is in high repute thirty-five years after its introduction, and in its extension to new fields.

Soon after Roentgen's discovery, skin changes following exposure to X-rays were observed by men using the new radiation. By 1896, depilation and other changes in the lesions of lupus, unaccompanied by damage to adjacent tissues, were observed. Soon after this, Senn obtained favorable results in leukemia by X-ray treatment and Albers-Schönberg demonstrated experimentally that the testicle could be destroyed without visibly injuring the skin. These early discoveries showed that X-rays had a selective action and stimulated efforts to develop radiation therapy for cancer.

Before long it was found that the actively dividing epithelial cells of a malignant tumor are particularly sensitive to radiation, while the resting cells which are not dividing rapidly are but little affected. This destruction of mitotic cells is due to the direct action of the radiation upon them. Whether or not there is also an indirect action manifested in hyperemia, reactions in the connective tissue of the tumor, stimulation of enzyme formation, etc., is still not definitely known.

Freund states that he regards himself as the first student of radiation to prove the following points: (1) Roentgen irradiation has a biologic action, (2) this action has therapeutic value, (3) radiation possesses also certain dangers, (4) the action of radiation is cumulative. He also recognized early the necessity of large doses and heavy filtration.

It was not many years before the first crude apparatus for generating X-rays was improved and the technical advance begun, which has finally resulted in our modern high tension transformers with their high voltage current and great intensity. This improvement in machinery caused Albers-Schönberg to develop the idea of giving the whole dose of radiation at one sitting and in a few minutes. This was the beginning of the massive-dose technic in therapy.

At this time there were no really accurate methods of measuring small quantities of radiation. However, it was comparatively easy to measure the large amounts used in these single massive doses, hence the exponents of this method considered theirs an accurate way and the fractional method an inaccurate one of administering radiation. In spite of the widespread acceptance of the massive dose technic, there were a number of radiologists—the author being prominent among them—who believed in the fractional method and continued to study and use it.

As early as 1902, the author reported a case of carcinoma of the mouth greatly improved by treatment by the fractional method. During the next twenty years many other similar reports were made concerning recurrent nodes, diffuse carcinoma of the mesenteric glands and the peritoneum, sarcomatous me-

tastases, etc. Although the individual doses in the fractional method were small, the total dose was large and the tissue-effect was more nearly continuous and constant than in single massive doses. The facts that there is no great difference in sensitivity between cancer cells and normal tissue and that the cancer dose must be large rendered damage to healthy tissue more probable in the massive dose method. Furthermore, these large doses did not completely destroy the tumor. Weichselbaum, at autopsy on women treated by massive radiation for carcinoma of the pelvic organs, found that the cancer was not destroyed and that fistulae and necrosis followed the treatment. The patients died in great suffering which was markedly increased by their reaction to radiation.

By 1919, it was established that the biologic action of radiation obeys Schwarzschild's theorem "The effect of radiation is delayed the longer the interval between treatments is in proportion to the single treatment, the shorter the individual treatment, and the smaller the intensity of the radiation." Thus, the biologic action of the fractional method appears gradually rather than suddenly.

In the same year Regaud, during his study of cases of cancer of the tongue in the Radium Institute at Paris, observed in the patients treated with large doses more damage to the normal tissues and less destruction of the tumor than in those treated with small, daily doses. From this time on, the fractional method has grown in popularity. The protracted use of small doses is called the saturation technic.

In the modern saturation method there are several important features: (1) The use of small, individual doses, (2) the prolongation of the radiation, (3) the high total dose, (4) the hardness and homogeneity of the radiation accomplished through heavy filtration and increased distance. The advantages of this method are the increased destructive action on cancer tissue and the decreased local and general reaction to the treatment.

The author considers the prolongation of the radiation as important as the large total dose. During a protracted series of treatments, the tumor remains for a considerable

period in a state of continuous radiation reaction. Research has shown that single organs of the body and even single cells possess varying sensitivity to radiation at different times. Because of this variation in sensitivity, prolonged radiation is likely to be more effective.

Severe local reactions are not seen in the fractional methods, and serious general reactions occur only in moribund patients. The author in his thirty-five years' experience has never had severe general reactions or serious injury to the skin in cases treated by the saturation technic.

In general, the fractional method is peculiarly adapted to carcinoma arising from the pavement epithelium of the skin and tending toward cornification. It is less effective in carcinoma arising from glandular tissue. It must not be imagined that there is no place for massive dose technic in radiation. If the tumor is growing rapidly and possesses high sensitivity, one should give a single, large, destructive dose, disregarding the possible reaction, in order to destroy the tumor quickly and completely. On the other hand, with deep tumors which are not very sensitive and grow slowly, one should use numerous smaller doses, all of which are above the threshold of therapeutic activity. With still deeper, larger tumors that are not very sensitive, larger doses at longer intervals are indicated in order to utilize both the destructive action of the larger individual dose and the selective action of prolonged radiation. In deep-seated lesions one should use heavy filtration and increased tube-skin distance.

No set rules can be formulated for fractional radiation. One of its advantages is that it can be adapted to the type of lesion under treatment. The length of the individual treatments, the length of the intervals, and the total dose will all differ according to the case in hand. The author, himself, has had good results when he has treated patients daily during a period of from fourteen to twenty-one days, using one or several portals of entry, depending on the size and location of the tumor, and employing hard, heavily filtered radiation. He repeats the series, if it seems best, after an interval of from four to six weeks. Freund

gives technical details of the methods advised by Miescher, Coutard, Schwarz, and Schinz. He emphasizes the fact that neither research nor experience has yet said the last word about the optimal size of the single or total dose, the length of the intervals between the treatments, or the duration of the series.

The selective action of the fractional method makes it valuable as a method of supplementing surgical removal of malignant growths, post-operative radiation may destroy malignant cells left behind the surgeon's knife. The author has urged, for many years, the radical surgical removal of neoplasms, followed by fractional radiation of the open, unsutured wound. This method is now beginning to be recognized by both physicians and surgeons.

Fractional radiation does not solve the cancer problem, but it deserves more consideration than it has hitherto received. One must not, however, go to the other extreme of abandoning entirely the massive dose, which has certain definite indications.

A L HART, M D

CHEST (DIAGNOSIS)

The Anteroposterior Projection of Oblique Profile for the Radiologic Examination of Only One Lung Dino Tartagli La Radiologia Medica, December, 1930, XVII, 1388-1395

The author has described the technic elsewhere (*Rev di Radiol e Fisica Med*, 1930, Fasc IV, A). He reproduces several films obtained by this method and points out its advantages, especially in the study of interlobar fissures, of conformation of the dia-phragm, and particularly in the localization of adhesions in therapeutic pneumothorax.

L MARINELLI

Some Considerations of the Interpretation of the Paramediastinal Shadow in a Case of Pulmonary Echinococcosis Luigi Pinelli Archivio di Radiologia, May-June, 1931, VII, 570-579

The author discusses a case of paramediastinal pulmonary echinococcus disease in

which there was nothing to suggest a cyst, the only symptom being the expectoration of bloody sputum. The author made the diagnosis after X-ray examination, and in this paper he discusses the differential diagnosis from a clinical and radiologic point of view, which led him to this conclusion.

E T LEDDY, M D

Two Cases of Exceptionally Long Delay in Eliminating Iodine after Bronchography G Cola Archivio di Radiologia, May-June, 1931, VII, 525-536

The first case was a girl who was examined because of the possibility of bronchiectasis. No bronchial dilatation or pulmonary cavity was revealed on X-ray examination, taken by the author's usual technic. The next day there was no change demonstrable in the bronchial shadows. The condition persisted for a week, when an attack of intense coughing brought on expectoration of the oil mixed with mucus. No untoward effect followed.

The second case showed, by bronchography, cavitation in the left base. The findings persisted for about a month and on the fortieth day there were shown only slight changes in the radiologic picture. These two cases are used by the author to illustrate the harmless ness of the examination.

E T LEDDY, M D

Cavitory Bronchospirochetosis Ferdinand- do Talia La Radiologia Medica, December, 1930, XVII, 1370-1387

The author describes two cases of cavitory spirochetosis of the bronchi. Radiographic ob-servations, practised systematically for three or four weeks, led him to conclude the fol-lowing:

(1) The cure is extremely slow, (2) ra-diographic characteristics are much like those seen in pulmonary abscesses, namely, slight opacity at the center and marked opacity at the periphery, (3) reparation processes take place centripetally, the tracks left may be seen as bands or as stripes of radial shape originating from the cicatricial tissue, (4) ra-

diologic result is bound to guide the observer toward the right diagnosis, provided due attention is paid to biologic control

L MARINELLI

Bronchiectasis in Children Gladys L Boyd Canadian Med Assn Jour, August, 1931, XXV, 174-182

Bronchiectasis has been regarded as a rare condition in childhood, despite the fact that from its earliest recognition as a disease entity its frequent inception in early life has been commented on by those who have studied it Laennec, in 1825, reported a series of cases studied by one of his assistants, Cajol, some ten years earlier In three of his four cases, the symptoms dated from early childhood Very little further reference is made to the disease in the young until the close of the century, when its childhood origin is again referred to by Clark, Hadley, and Chaplin in their monograph on fibroid disease of the lung In 1905, Clive Riviere described 33 cases, 23 of which began before five years of age This author gave a classification of the main types of the disease, and also described its pathology and main methods of production Since this time numerous articles have appeared dealing particularly with the etiology and pathology of the disease, but until 1922, when Sicard and Forestier introduced the use of lipiodol for the depiction of the disease, few have dealt with its clinical course or diagnosis Case reports have been frequent since the discovery of these Frenchmen

The author's report is based on the study of 56 cases observed at the Hospital for Sick Children, Toronto, during the past ten years The diagnosis has been made possible largely by the use of the bronchoscope

The age incidence has been from two months to ten years The sex distribution was about equally divided between the male and the female

The variety of pulmonary conditions with which bronchiectasis is associated makes it difficult to determine the causative factor The consensus, however, assumes the bronchial dilatation to be secondary to some infection or injury of sufficient severity to disorganize the

integrity of the bronchial wall The persistence or severity of the infection, and subsequent infections, then increase the ectasis by the fibrosis produced in healing, or produce further destruction

The following factors led to the disease in the author's cases Bronchopneumonia 23, chronic bronchitis 7, measles and pertussis 5, pertussis alone 5, measles alone 4, influenza 4, empyema 4, tonsillectomy 2, lung abscess 2, cough 2

No specific bacteria have been found In the majority the infection was not only mixed, but the flora varied from time to time in the same patient Cultures of turbid or even purulent fluid aspirated from the paranasal sinuses were at times disappointingly sterile Hemolytic streptococci occurred alone or in combination more frequently than any other organism The close relationship between bronchiectasis and tuberculosis was not brought out in this series

Opinions differ as to the method of production of bronchiectasis, but all agree on its secondary nature Two factors seem to be essential in the production of bronchial dilatation (1) Obstruction of a bronchus, particularly if this be partial, and (2) infection If the former is present without the latter the tendency is toward the production of emphysema rather than ectasis

As to the gross pathology, probably the most striking feature is the degree and density of the pleural adhesions This is seen even in infants Bronchial dilatation develops with great ease in children suffering from bronchopneumonia, particularly in cases in which the latter is caused by measles, pertussis, or influenza

From the standpoint of signs and symptoms, the most characteristic thing about bronchiectasis is said to be the very slight degree of impairment of general health This view, so commonly held, has not been confirmed in this series The children were considerably underweight, pale, and tired easily They were seldom able to attend school regularly, and were subject to periods of exacerbation, when they had to remain in bed

The important symptoms are cough—which

is always present—sputum, hemoptysis, dyspnea, and night sweats. Fever may be entirely absent.

Physical signs are not pathognomonic, in fact, may be entirely absent, except during a flare-up. Shifting of the mediastinum to the affected side may be observed. Clubbing of the fingers and toes is sometimes present. Albuminuria is seldom found.

The diagnosis may be made from the X-ray film. Sometimes the ordinary stereoscopic films may be sufficient to establish the diagnosis. The "honey-combing" seen in the lower lobes is pathognomonic. Fortunately, all cases have not progressed far enough to give this characteristic appearance. In such cases, the suggestive findings are extensive fibrosis, cardiac displacement, blurring of the cardiohepatic angle, enlargement of the hilus glands, with no other evidences of tuberculosis. The absence of these findings does not, however, rule out bronchiectasis.

The greatest aid in the modern methods of diagnosis of bronchiectasis, the injection of lipiodol into the bronchi, is described in detail by the author.

The prognosis is varied. Sometimes there is spontaneous recovery. Sometimes the condition progresses in extent of lesion and effect on the general health of the child. Very seldom does it progress to a fatal termination.

The treatment has been greatly changed in the last two years at the Hospital for Sick Children. Previous to that time the main attention was devoted to improving the general health of the child rather than to any attack on the disease process itself. The plan of treatment at present carried out is as follows. Bronchoscopic examination, with the injection of lipiodol in (a) unilateral cases—pneumothorax, repeated bronchoscopic suction, postural drainage—and in (b) bilateral cases—repeated aspiration, postural drainage, lipiodol.

It is too soon to make any statements as to the results of treatment.

L. J. CARTER, M.D.

Pseudotuberculosis from Bronchospirochetosis of Castellani. G. Cola. Archivio di Radiologia, May-June, 1931, VII, 490-508.

This is a pulmonary lesion first described by Castellani, in Ceylon, in 1905, and which has been subsequently reported not only in the Far East but in most of the countries of Europe. The etiologic agent is the *Spironema bronchialis* of Castellani, which is present in enormous quantities in the sputum and in the bronchial mucosa of patients suffering with this disease. Clinical diagnosis is made by demonstrating the organism. The prognosis is generally favorable.

The treatment consists in the administration of arsenicals, antimony, or iodine. The author reports two cases of this rare disease and discusses the clinical and radiologic findings. The radiographic picture is not pathognomonic, but the essentials in it are marked enlargement of the hilar shadow, accentuation of the lung markings, the presence of striæ and scattered micro-granular spots in the upper half of the lung, and apical opacity and retraction.

The author emphasizes the importance of the recognition of this disease. The article concludes with a bibliography of twenty-two references.

E. T. LEDDY, M.D.

CHEST (GENERAL)

Pleuro-pulmonary Complications Following Costal Fractures. Stefano Bistolfi. La Radiologia Medica, November, 1930, XVII, 1255-1308.

The conclusions reached by the author in a review of 1,800 radiographs of injured workers are as follows:

(1) Pleuro-pulmonary complications, due to fracture or trauma of the ribs, are not very frequent.

(2) The age of the injured may or may not be a factor, because although in youth greater elasticity of the organs diminishes the vulnerability of both ribs and underlying tissues, a greater yielding of the thorax would, on the other hand, cause a larger trauma area (between the ribs and pleuro-pulmonary tissues).

(3) The presence of lesions of the pleura and lungs following fracture of the ribs is a rather common occurrence according to radiologic investigation, it must be admitted how-

ever, that these organs show a very marked resistance to traumatic agents

(4) In healthy subjects, pleuro-pulmonary trauma is followed by local reparative processes, which take place in a short time and in a very satisfactory way, regardless of the seriousness of the lesion

(5) Complications occur in weak patients, especially tuberculous ones

The author advocates the most careful radiologic examination in cases of trauma or fractures of the ribs, so that the danger of impending complications may be effectively reduced in the most favorable period

L MARINELLI

Intrathoracic Neoplasms A A Rowan
Canadian Med Assn Jour, October, 1931,
XXV, 401-407

The author presents case reports of five admissions to Ste Anne de Bellevue Hospital, Quebec, made during the last two years

From a diagnostic standpoint, the author discusses the value of the radiograph. He considers that the value of the information gained from X-ray films and from physical signs, and particularly from the laboratory reports, is of most value from a negative standpoint.

The value of an X-ray film depends upon the area of lung presented to view and the clearness with which detail is brought out. In advanced cases such detail must not be obscured by pleural opacities. But even if only one side of the affected lung is shown clearly the films will be of value, as tuberculosis is usually bilateral, and affects chiefly the upper third. The withdrawal of fluid and its replacement by artificial pneumothorax as a diagnostic measure should be tried.

The chief interest of the radiologist in the author's series lies in the comparison made between the X-ray findings and the autopsy reports.

In the first case the X-ray examination showed a pneumonic area of the right upper lobe, the whole lobe being involved, thickened pleura on right diaphragm, trachea displaced to the right, left lung clear. The films showed an opacity above the interlobar line

which might have been due either to pleurisy or to atelectasis. In the further course of the disease the entire right lung area became opaque from pleural effusion. The diagnosis was pleurisy with effusion, neoplasm on the right side, of bronchial or pulmonary origin, possibly with pleural involvement. Autopsy showed the right lung collapsed below and above the second and third ribs where there was a bridge of lung tissue between. The two pleural cavities so formed contained a quart of thin straw-colored fluid which was not blood-stained. The lung was hard and contained bronchiectatic cavities at the base. Microscopic examination showed primary carcinoma of the right lung, with extension to both layers of the pleura, to the diaphragm, to the mediastinal tissues, and the pericardium. There was also involvement of the diaphragmatic peritoneum and mesentery.

In the second case the X-ray examination showed the following. Outline of heart obscured but enlarged to the left, increased density at the right base, mottled area over both lungs. Appearance might be caused by a new-growth at the right base. A comparison of films taken a month later showed Right diaphragm not made out, ground-glass appearance up to the third and fourth ribs. Star, or cloudy vague-shaped areas seen down to the fifth and sixth ribs, with smaller and similar areas among them. Left Heart shadow very irregular, merging with cloudy and fainter small areas resembling tubercles existing throughout the lung. Diaphragm made out with much haziness above it. Scoliosis of spine to the left. In comparison with the first films there seems to be a great extension.

The autopsy findings showed neoplasm of the right and left lungs, with metastases in the liver and mediastinal glands. Endocarditis is seen best in the aortic cusps. There are dense pleural adhesions. The microscopic findings are primary carcinoma of the right lung, with metastases in the left lung, pericardium, liver, retroperitoneal, and mediastinal glands.

In Case 3, the X-ray examination showed the heart, aorta, and trachea displaced to the left, an appearance of compensatory emphy-

sema of the right lung, left half of the diaphragm invisible, a dense area above it, suggestive of thickened pleura. This appearance might also be caused by fluid. This area extended from the base to the fourth rib in front, the heart shadow was half way out in the field. In two weeks' time the heart, aorta, and trachea were found displaced to the right. The lower two-thirds of the left chest were dense, with the appearance of fluid. In spite of repeated negative sputum examinations for tubercle bacillus, a diagnosis of pulmonary tuberculosis was felt to be the only explanation of the findings.

The autopsy showed a great ragged walled cavity in the lower two-thirds of the left lung. Microscopic examination revealed a primary epidermoid carcinoma of the left lung.

In Case 4, the X-ray examination showed a much enlarged heart, with broadened aortic shadow, suggesting aneurysm and fluid at the right base. Six weeks later the lower two-thirds of the right lung was uniformly dense, suggesting fluid or newgrowth. The heart and great vessel shadows were now of normal size. A diagnosis was made of cancer of the lung.

The author does not give the terminal result in this case.

In Case 5, the X-ray examination showed opacities on both sides of the chest, the upper borders of which were not clear or level. Above the level of opacity at the third rib there were no markings suggestive of tuberculosis or tumor. The heart and mediastinal shadows were almost indistinguishable from the general lower thoracic opacity. The diagnosis was failing cardiac decompensation, myocarditis, and pleurisy.

Autopsy revealed a massive tumor involving the whole anterior mediastinum and growing down over the pericardium. The heart, lung roots, and lungs and pleura were involved. The mediastinal mass was the size of a man's head, and occluded by pressure the great vessels, the esophagus, and the trachea. The microscopic diagnosis was lymphosarcoma.

Regarding the value of the X-ray examination in lung tumors, the author reaches the

conclusion that it is only helpful in proportion as the extent of thoracic contents is visible above pleural opacities, should such be present.

L J CARTER, MD

CONTRAST MEDIA

Effect of the Radio-opaque Substances on the Walls of the Vessels L Docimo L'Ateneo Parmense (Suppl), 1931, III, 42-58

The author believes that the employment of arteriography, when limited to the arteries of the extremities, is of evident value, especially in cases of embolism and obliterative thrombo-angiitis. It is, seemingly, the only method for determining with approximate accuracy the seat of the embolism or the point at which the eventual amputation of a member must be made in order to avoid the danger of excessive mutilation or of cutting into a segment insufficiently nourished, with all the consequences of defective vascularization of the borders.

The problem, however, despite all that has been written on the subject, has not yet been thoroughly studied, especially as regards the radio-opaque substances which should be employed. The opaque substances which have thus far been used for purposes of contrast have varied both in nature and in concentration, this variety seeming to indicate that each of them possesses both advantages and disadvantages, whereas it would be preferable to have recourse to a single substance recognized as the one best adapted to the needs of the case and as the least injurious. An opaque substance, in order to be applicable as a means of contrast in the circulating blood, should be harmless to the organism, should cause no disturbance of the circulation or alteration in the vascular walls, and, in addition, should give a clear image, so as to render the field of exploration distinctly visible.

For purposes of elucidating the problem, the author used dogs to study experimentally the effects, on the vascular walls, of solutions of iodide of potassium, bromide of sodium, iodide of sodium, and uroselectan, when used as means of contrast in arteriography. He found that, while the other substances give

rise to marked vascular alterations, uroselectan does not produce any changes, showing that it is completely neutral as regards the injected vessel

W W WHITELOCK, Ph D

Pulmonary Angiography with Uroselectan Adelchi Salotti Archivio di Radiologia, May-June, 1931, VII, 633-639

The author gives a preliminary report on some studies he has made on the circulation in the lungs and hilum and on the radiologic appearance of the superior vena cava. Some interesting findings were brought out which the author feels will be of greater importance clinically as the technic of the examination is improved

E T LEDDY, M D

The Use of Iodized Oil by the Sanatorium Physician in the Diagnosis of Bronchial Affections Stuart Pritchard Jour Michigan St Med Soc, July, 1931, XXX, 506-508

Each method of visualizing the bronchial tree has its advantages. The supraglottic method is perhaps the least complicated, and most simple and time saving for the sanatorium physician, the clinician, and the radiologist.

This method does not require a trained specialist, and the injection causes the patient less strain and worry and little inconvenience. No ill effects have been observed by the author in six years of experience. The method may be employed in fluoroscopic room, office, or hospital, and any part of the bronchial tree may be visualized. It is useful in long-standing bronchitis of indefinite etiology, in cases of chronic cough with expectoration and no definite X-ray pathology, cases of chronic cough with history of pneumonia or foreign body, and in bronchiectasis. As stated in 1926, contra-indications are acute respiratory infections, acute or active tuberculosis, extensive or advanced pulmonary suppuration in a weak patient, advanced circulatory complications, and recent hemoptysis.

W W WATKINS, M D

DIATHERMY

Diathermy E P Cumberbatch Canadian Med Assn Jour, August, 1931, XXV, 164-167

The only way in which external heat can get into the tissues is by radiation or conduction. The electric current, however, passes through the body and actually generates heat within the tissues. Heat which is generated in this way and distributed through the tissues is known as diathermy.

Currents like the faradic, galvanic, and sinusoidal are quite unsuitable for heating purposes within the body, because they would produce unbearable contractions of the muscles and dangerous changes within the tissues long before they reached a strength sufficient to heat the body. It is necessary, then, to deprive the current of its power to stimulate muscle and nerve and to produce chemical changes. This can be done by making it alternate, or oscillate, about a million times per second. This is known as a high frequency current. Not all high frequency currents will, however, produce a perceptible diathermy. High amperage must be used to produce heat.

The therapeutic properties of high frequency currents are due to heat, and heat only. By means of the diathermy current, the power of heat to relieve pain and spasm, to aid resolution of inflammation, and to assist the tissues in freeing themselves from infection, can be brought about in regions which are beyond the reach of other thermo-therapeutic agents. The therapeutic field of diathermy is, therefore, a wide one.

It is in the treatment of certain diseases of the pelvic organs in women that diathermy has made the most striking advances. By introducing a special electrode into the urethra and completing the circuit by means of a pelvic belt electrode, the part mentioned can be heated to 114° F (the maximum bearable without pain) and freed from infecting gonococci, in about 90 per cent of the cases. The same is true of the cervix uteri, when treated in the same manner. If the infection is not gonococcal, it can be removed in about 80 per cent of the cases. By means of a spe-

sema of the right lung, left half of the diaphragm invisible, a dense area above it, suggestive of thickened pleura. This appearance might also be caused by fluid. This area extended from the base to the fourth rib in front, the heart shadow was half way out in the field. In two weeks' time the heart, aorta, and trachea were found displaced to the right. The lower two-thirds of the left chest were dense, with the appearance of fluid. In spite of repeated negative sputum examinations for tubercle bacillus, a diagnosis of pulmonary tuberculosis was felt to be the only explanation of the findings.

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the presence of air spaces in the phantom, within the medium they cause changes of the order of plus 17 per cent for air spaces located above the ionization chamber and of the order of from -4 to -6 per cent for lateral or underlying air spaces

The author thinks, however, that, considering the conditions usually encountered in roentgenotherapy, measurements obtained from phantoms supply the values of doses at different depths of the human body with a reasonable degree of approximation

L MARINELLI

What Is the Ovarian Dose in r Units?
Heinrich Martius *Strahlentherapie*, Sept 12, 1931, XLII, 160-164

The author has made an attempt to determine the average dose expressed in r necessary to bring about amenorrhea in women. He emphasizes that the figure derived from his statistical studies has no absolute significance, because too many variable factors enter into this problem. However, he comes to the conclusion that 290 r effective in the ovaries will in all probability sterilize the majority of women

ERNST A POHLE, M D , Ph D

On the Principles of Balneologic Radium Therapy Quantitative and Energetic Considerations of the Problem of Physiologic Dosage in Emanation Therapy Jaromir Markl *Strahlentherapie*, Oct 3, 1931, XLII, 249-280

The author analyzes in this paper the problem of dosimetry in emanation therapy, if the emanation is applied through contact (as a bath), taken in solution *per os* or inhaled through the lungs. He determined the amount of emanation in the blood for several hours after the administration and plotted the curves. This permitted the calculation of the energy per cc and second in erg. Following a bath in water charged with emanation the concentration in the blood increases up to a maximum and then slowly decreases. After four hours the major amount of the emanation has disappeared from the blood and only a small amount of activity remains.

Two types of curves were seen following application by mouth, one type with a steep slope and one with a very gradual slope. The rise of the emanation in the blood is rather rapid and reaches its maximum within a few minutes. The excretion varies considerably and is sometimes finished within an hour, sometimes taking more than two hours. The author states that after drinking about 200,000 ME, approximately 10,368 alpha particles are effective in 1 cc of tissue during a two-hour period, this corresponds to an energy of 1.73×10^{-5} erg per second and cubic centimeter. In the emanatorium the concentration of the emanation in the blood increases slowly and reaches its maximum after an hour. It drops rapidly as soon as the patient has re-entered a room with ordinary air. Within four hours the greater part of the emanation has been excreted. As to the effectiveness of the three methods of administering emanation, it seems that the emanatorium where the emanation is inhaled takes first place. The author also discusses the possible mechanism of the action of emanation on the organism.

ERNST A POHLE, M D , Ph D

Suppurative Otitis Media. Pedro L Errecarrt *Rev Med Cubana*, October, 1931, XLII, 1218-1228

In this article the subject of suppurative otitis media is thoroughly discussed from etiology to treatment.

The description of the necessary otoscopic examination is particularly instructive and quite complete. The author further discusses the differential diagnosis in detail, naming the most common conditions to be differentiated, and goes on to describe each condition.

In complicated cases in which the otolaryngologic methods of examination are not sufficient to accurately diagnose a condition, the author resorts to X-ray as a means of examination and finds it most valuable in determining or ruling out the presence of mastoiditis.

JOSEPH MALDONADO, M D

THE ESOPHAGUS

Esophageal Spasm in the Child Enrico

cial vaginal electrode it is possible to remove infection of the fallopian tubes and the pelvic supporting tissues in the great majority of cases. Congestive dysmenorrhea can always be cured by diathermy, but the spasmodic type is only temporarily benefited.

In male subjects, the prostate and vesicles can be subjected to diathermy by way of a special electrode. This treatment will always bring gonorrhreal fibrosis or arthritis to an end. In anterior urethritis diathermy has no special value, but in gonococcal epididymitis and orchitis its action is remarkable.

There is sufficient evidence now to show that extracardiac diathermy is valuable in angina pectoris. In cases of hypertension the action of diathermy is to lower blood pressure and relieve the symptoms.

In some cases of chronic bronchitis the application of diathermy to the chest gives lasting relief. The same results have been obtained in some cases of idiopathic asthma. In lobar pneumonia, diathermy can relieve pain and produce sleep after all other methods have failed. It is of great value in mucous colitis.

Diathermy is of great value in surgery. Both malignant and innocuous growths can be heated and their temperature raised until the tissue proteins coagulate. This form of treatment has many advantages. There is no disturbance of the anatomic continuity of the growth, no cutting or scraping, and no loss of blood. The vessels are sealed. The patient does not suffer from shock after the operation. The resulting slough is quickly replaced by granulations, and the resulting scar does not shrink or form adhesions.

Latest developments are the diathermy knife and fulguration.

L. J. CARTER, M.D.

DOSAGE

Energy Distribution in Deep Roentgen Therapy Arduino Ratti. *La Radiologia Medica*, November, 1930, XVII, 1213-1250

The author reviews briefly the work done in the field of roentgen dosimetry and the differential methods employed, giving a comprehensive picture of the errors which are apt to occur in determinations of this sort. His in-

vestigations were performed with a 155 KV constant potential machine, a HVL of 0.85 mm of Cu and under a filtration 0.5 mm of Cu plus 3.0 mm of Al. They consist of:

(1) Determination of the amount of secondary radiation present at the surface of a scattering medium (paraffin block 30 X 30 X 20 cm). This test was performed with five different dosimeters and showed an increase of from 36 to 43 per cent of the primary intensity at a TSD of 30 cm with 6 X 8 cm field to 63 per cent with a field of 20 X 20 at 40 cm TSD.

(2) Determination of the intensity at a depth of 10 cm, expressed in percentage, of the intensity at the surface; the results range from 28 per cent for 6 X 8 cm field, TSD equals 30 cm, to 48 per cent for a 20 X 20 field at 40 centimeters.

(3) Determination of the ratio of the intensity of the beam emerging from a given part of the human body to the intensity of the X-ray beam at the surface; this experiment was performed with the intention of checking the reliability of the results obtained in paraffin. No mention is made of the procedure followed, although the author admits that measurements on the body cannot be considered as technically exact as those made on the phantom; results, however, show no large discrepancy between the tests.

(4) Investigation of the conditions which are apt to decrease the intensity in a scattering medium.

This experiment includes the determination of absorption of vertebrae as compared with that of rice. No remarkable difference was found and indirect experiments confirm the belief that a large increase in the density of bones would not have affected the results.

Any effect due to the presence of bodies of high density (Cu, Pb, etc.) decreased as the size of the irradiated field was increased. The same general considerations apply to the study of "depth dose" in the skull.

(5) Investigation of the conditions which are apt to increase the intensity in a heterogeneous medium.

The conclusions reached are: The change in surface intensity is not affected appreciably by

the presence of air spaces in the phantom, within the medium they cause changes of the order of plus 17 per cent for air spaces located above the ionization chamber and of the order of from -4 to -6 per cent for lateral or underlying air spaces

The author thinks, however, that, considering the conditions usually encountered in roentgenotherapy, measurements obtained from phantoms supply the values of doses at different depths of the human body with a reasonable degree of approximation

L MARINELLI

What Is the Ovarian Dose in r Units?
Heinrich Martius *Strahlentherapie*, Sept
12, 1931, XLII, 160-164

The author has made an attempt to determine the average dose expressed in r necessary to bring about amenorrhea in women. He emphasizes that the figure derived from his statistical studies has no absolute significance, because too many variable factors enter into this problem. However, he comes to the conclusion that 290 r effective in the ovaries will in all probability sterilize the majority of women.

ERNST A POHLE, M D , Ph D

On the Principles of Balneologic Radium Therapy Quantitative and Energetic Considerations of the Problem of Physiologic Dosage in Emanation Therapy Jaromír Markl *Strahlentherapie*, Oct 3, 1931, XLII, 249-280

The author analyzes in this paper the problem of dosimetry in emanation therapy, if the emanation is applied through contact (as a bath), taken in solution *per os* or inhaled through the lungs. He determined the amount of emanation in the blood for several hours after the administration and plotted the curves. This permitted the calculation of the energy per c c and second in erg. Following a bath in water charged with emanation the concentration in the blood increases up to a maximum and then slowly decreases. After four hours the major amount of the emanation has disappeared from the blood and only a small amount of activity remains.

Two types of curves were seen following application by mouth, one type with a steep slope and one with a very gradual slope. The rise of the emanation in the blood is rather rapid and reaches its maximum within a few minutes. The excretion varies considerably and is sometimes finished within an hour, sometimes taking more than two hours. The author states that after drinking about 200,000 M E, approximately 10,368 alpha particles are effective in 1 c c of tissue during a two-hour period, this corresponds to an energy of 1.73×10^{-5} erg per second and cubic centimeter. In the emanatorium the concentration of the emanation in the blood increases slowly and reaches its maximum after an hour. It drops rapidly as soon as the patient has re-entered a room with ordinary air. Within four hours the greater part of the emanation has been excreted. As to the effectiveness of the three methods of administering emanation, it seems that the emanatorium where the emanation is inhaled takes first place. The author also discusses the possible mechanism of the action of emanation on the organism.

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The conclusions reached are: The change in surface intensity is not affected appreciably by

which prevents or hinders spontaneous precipitation in rabbit serum

(2) Flocculation is the result of physical or chemical conditions which are progressively established by anaphylactic process

(3) Radiation, by opposing the establishment of these conditions, decreases both flocculation and anaphylactic charge, including the physio-pathologic phenomena of crisis and shock

(4) Similar action of radiations on serum *in vitro* lends credence to the existence of antagonistic action of X-rays on the colloidal state of vital plasms independently of any cellular activity

L MARINELLI

Application of Radio-active Substances with Long Half Life Period in Medicine. A Ostrčil and F V Novák *Strahlentherapie*, Oct 3, 1931, XLII, 291-306

This is a preliminary report of experiments with a silver emulsion containing a radio-active deposit, which was injected in five cases with malignant tumors. The authors were particularly interested in obtaining a preparation with an activity of long duration. The ionization measurements and animal tests leading to the development of the preparation are briefly discussed. Although no definite statements as to the efficacy of this injection treatment can be made, the authors feel justified in continuing their work

ERNST A POHLE, M D , Ph D

Tissue Metabolism Following Roentgen Exposure Experimental Investigations on the Liver and Kidney J Heeren and J Pansdorf *Strahlentherapie*, Oct 3, 1931, XLII, 307-327

The authors studied the metabolism of tissue following irradiation. Liver and kidney of mice and rats were used for the determinations, which were carried out with the method of Warburg (manometer method). The roentgen exposure was given over the entire abdomen. The technic was as follows 185 KV 5 ma 0.5 mm Cu, 30 cm TSD, 550 r (in air). The amount of oxygen used by liver and kidney tissue was determined immediately

and one hour following irradiation. If the tissue had been suspended in Ringer's solution, there was always a definite increase in the oxidation, both in liver and kidney tissue, lasting about 40 minutes. This increase was not found when the tests were carried out at a later time. The increase of the oxidation depended also upon the dose. If horse serum was used for the suspension of the tissue, the increase in oxidation could not be demonstrated regularly

ERNST A POHLE, M D , Ph D

Some Effects of Ultra-violet Rays on the Vitamin D Content of Plants as Compared with the Direct Irradiation of the Animal Mary Lojkin Contrib Boyce Thompson Inst, 1931, III, 245-265

Standard white rats are fed a rickets-producing diet and tested for their response to sunlight, to ultra-violet irradiation, and to the curative effect of vegetables grown under different conditions. The amount of calcification was estimated by the AgNO_3 line test or by determination of percentage of ash in the femur

Greenhouse plants did not produce Vitamin D. Ultra-violet rays from the sun and from the Hg vapor lamp impart antirachitic value to lettuce, alfalfa, spinach, and soy-bean, but none to cabbage. Greater antirachitic properties are imparted to the cut than to the intact plant. Such antirachitic activation is not destroyed in twenty-four hours. Complete protection was afforded rats exposed to the rays of the Hg vapor lamp for one minute per day. The wave length most effective is that within the limits of solar radiation. The time required for sunlight protection varies with the season. The exposure necessary to produce Vitamin D in the plant is proportionately longer than that required to impart protection by irradiation of the animal

CHEMICAL ABSTRACTS

The Repair *in Vitro* of Embryonic Skeletal Rudiments after Experimental Injury Janet S F Niven Jour Path and Bacteriol, May, 1931, XXXIV, 307-324

Benassi La Radiologia Medica, November, 1930, XVII, 1334-1345

This is a description of two typical cases of this anomaly which is extremely rare in children. The patients were six- and seven-year-old girls. In both, the location of the spasm corresponded to the esophageal hiatus of the diaphragm. The author attributed its presence to nervous or hysterical phenomena in each case, his hypothesis being confirmed by the excellent results obtained by the administration of bromides and belladonna.

L. MARINETTI

EXPERIMENTAL STUDIES

Susceptibility to Tumors Some of the Factors Governing the Same Charles L. Connor Calif and West Med., May, 1931, XXXIV, 325-329

The inoculable tumor may be transmitted by filtered juice or dried, presumably dead tissue, but the transplantable tumor requires living cells. The purpose of the paper is to point out the laws governing these tumors, to indicate an analogy between experimental and human tumors, and to show how experimental factors may be altered.

The adaptation of the Rous fibrosarcoma to various strains of chickens is noted as an adaptation of tumor cells to animals, and in the adaptation of animals to tumors, reference is made to the Sive strain of mice and to the Buffalo strain.

The laws governing the transplantation of normal tissue are noted. But because of lack of genealogic knowledge, the factors regarding human-tumor susceptibility are less well-defined. There has been very little transplanting of human tumors.

Under the general subject of spontaneous retrogression of tumors an etiology has not been proven, and the chance of systemic therapy is very remote if the cause be found to be racial or hereditary. A number of factors is given which will alter the rate of growth or the susceptibility to tumors. The wide variety of methods used, the number of different species of animals studied, and the variation in types of tumors which are affected in different ways by the same substances indi-

cate also that probably no single substance or method will ever be found that will have a uniform effect on all tumors.

FRANCIS B. SHELDON, MD

Some Biologic Effects of Radio-active Substances Study No 1—Effects on a Transplantable Mouse Carcinoma John W. Spies Am Jour Cancer (Suppl.), July, 1931, XV, 2173-2181

The author gave uranium-thorium mixture intravenously and subcutaneously to mice bearing Twort transplantable mouse carcinoma. He concluded that the radio-active substances accelerated the increase in volume of the neoplasm. This in turn shortened the span of life. The factors of necrosis, hemorrhage, and liquefaction could not be ruled out. Large doses of the uranium-thorium mixture produced acute nephritis in some instances, but small doses produced no anatomic lesions of the viscera.

JOHN R. CARTY, MD

Some Biologic Effects of Radio-active Substances Study No 2—Effects on the Normal Rabbit John W. Spies Am. Jour Cancer (Suppl.), July, 1931, XV, 2182-2201

The author found that normal rabbits when injected with a uranium-thorium mixture showed no weight changes and there were no constant blood cell changes. There was a questionable lowering of the blood sugar level, but the cholesterol and blood non-protein nitrogen were probably not altered. Fecundation was not suppressed. There were questionable lesions superimposed on a previously existing spontaneous nephropathy.

JOHN R. CARTY, MD

Serum Anaphylaxis and Rays Luigi Capelli La Radiologia Medica, November, 1930, XVII, 1308-1316

This is an experimental study which follows many others by the same author on the investigation of the mechanism of the action of roentgen rays. The following conclusions may be drawn from it:

(1) Roentgen radiation tends to develop a physical and chemical action on vital colloids

Visualization of the Cornea Hugo Ahlbom
Acta Radiologica, 1931, XII, 212-235

The author reviews all the past work on the localization of foreign bodies in the eye and, describing his method of localization, attempts to show its superiority over Sweet's method. Like Sweet, he attaches no contact markers to the eyeball.

In the Sweet method, the location of the foreign body is not gained directly from the plate, but is arrived at by a geometric computation of displacement with different projection angles, while in the author's method, the plates themselves show clearly in lateral and anteroposterior projections the actual position of the foreign body.

In the anteroposterior view, he uses a wire ring so placed that its center is in line with both the tube focus and the center of the pupil. He thus determines the relation of the foreign body to the center of the eye. In the profile view, obtained by an oblique position of the head and fixation of eyeball at right-angles to the X-ray beam, he uses an aluminum wedge against the cassette to make the cornea visible for a landmark. He thus determines the depth of the foreign body. Every detail necessary for the adoption of the method he explains carefully and for each step he gives the justification.

He points out the following disadvantages of Sweet's method:

(1) An expensive apparatus is necessary and the adjustments are complicated. The author, on the other hand, uses only appliances that are to be found in the regular laboratory equipment and which require no complicated adjustments.

(2) The short target-film distance causes some distortion, as much as 3 mm being produced when the foreign body is situated far back in the eyeball. The author uses a tube-film distance of nine feet and there is no distortion.

(3) The patient may alter the direction of vision during exposure, as there is no means for directly observing him at this time. A comparatively slight change in the direction of vision results in considerable error. With the

author's method, the patient is closely observed while the film is being taken.

NATHAN FLAX, M.D.

Foreign Bodies in the Air Passages Their Diagnosis and Removal William B Faulkner and Edward C Faulkner Calif and West Med, July, 1931, XXXV, 12-18

A history of aspiration is often overlooked but usually is very significant. The physical findings will depend, to a great extent, on the type of obstruction to the air flow, the position of the foreign body, and the amount of obstruction. The location and amount of secretion, also, will have a great deal to do with the physical findings. X-ray (fluoroscope and film) findings are very important. If the foreign body is opaque to the ray, it is easily located.

In non-opaque foreign bodies the diagnosis will depend on changes in the lung, which, in turn, will depend on whether or not the air passage is obstructed. If there is no obstruction by the non-opaque foreign body, the X-ray findings may be entirely negative. Then bronchoscopy must be resorted to. The authors discuss this procedure and the mechanics of foreign-body removal. The sooner the foreign body is removed, the less chance there is of complications.

FRANCIS B SHELDON, M.D.

GALL BLADDER (NORMAL AND PATHOLOGIC)

Indications for Cholecystic Surgery A R Monroe Canadian Med Assn Jour, September, 1931, XXV, 276-279

The object of the author is expressed as an attempt to adjudicate on the various methods of diagnosing cholecytic disease. Once disease of the gall bladder is established the organ should be removed. The results of gall-bladder surgery are so satisfactory that we may justly claim that the rules governing surgery of the appendix should apply to the gall bladder.

The history is important. Often in gall-bladder disease the history is sufficient to en-

In order to study the part played by the various constituents in the repair of bone following injury, owl and mouse embryonic rudiments were cultivated *in vitro*.

It was found that results depend greatly on the period of embryonic life at which the injury is made.

For a detailed description of the processes that occur and the excellent accompanying photomicrographs reference should be made to the original article.

E C VOGT, M D

The Effects of Repeated Intrapleural Injections of Electrolytes in the Rabbit—Acquired Insensitiveness of the Lung Epithelium to a Proliferative Stimulus The Bearing of the Observations on Tissue Resistance J S Young *Jour Path and Bacteriol.* May, 1931, XXXIV, 357-377

Hyperplasia of the epithelium lining the marginal alveoli of the lung of the rabbit can be produced by a single intrapleural injection of $\frac{3}{4}$ N solution of strontium chloride. A second injection within fifteen or twenty days of the first fails to produce further reaction but at a longer interval it becomes effective again.

If injections are started with weak solutions intercurrent hyperplasia can be prevented and finally no reaction is produced by an injection of N/1 solution which would otherwise cause a severe reaction.

The reaction is not strictly specific, as calcium chloride affords some protection against strontium chloride.

It is concluded that these observations are consistent with the hypothesis that cell-division is initiated by precipitation of the colloids of the cell membranes.

E C VOGT, M D

Anaphylaxis and Rays Alkaline Reserve Luigi Cappelli *La Radiologia Medica*, December, 1930, XVII, 1361-1369

This article is essentially a review of the results obtained by the author on a long series of experiments performed on rabbits and human beings, which were previously published in the same journal. He concludes that,

aside from a tendency to produce alkalinity in serum irradiated *in vitro*, roentgen radiation does not produce any noticeable change in alkaline reserve, pH, chloride content of the blood, or acidity in urine.

L MARINELLI

Experimental Rickets T Skaar *Acta Pediatrica*, 1931, XII, Supp I, 1-136

This article occupies the entire supplement and gives in detail the extensive investigations of the author on the calcium, phosphorus, and magnesium metabolism in rickets. The purpose of these experiments was to examine calcium and phosphorus metabolism during the development, existence, and improvement of experimental rickets. Puppies were used as test animals. The experiments are well controlled and have to do with the effect of vitamin deficiency as well as the mineral intake. Some observations are also made on the effect of Vitamin C on the calcium and phosphorus metabolism.

The article is published in English and is accompanied by a comprehensive bibliography.

E C VOGT, M D

THE EYE (DIAGNOSIS)

Metastasis in the Sheath of the Optic Nerve from Carcinoma of the Stomach Isadore Goldstein and David Wexler *Archiv Ophthalmol.*, September, 1931, VI, 414-419

The authors report a case of ulcerating carcinoma of the stomach metastasizing to the abdominal viscera and peri-aortic glands and the sheath of the optic nerve, with absence of visual disturbances. The invasion was probably through the blood stream. They report four cases on record, previous to 1922, arising from carcinoma of the breast, kidney, and bronchial glands, but none from gastric carcinoma.

RAYMOND V MAY, M D

FOREIGN BODIES

A New Method of Localizing Foreign Bodies in the Eye Teleradiography with

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The history is important. Often in gall-bladder disease the history is sufficient to en-

able one to make a diagnosis without laboratory tests, and will almost always attract our attention to this organ when not sufficient to convict it of harboring disease.

The physical examination may reveal much or little. In most cases the history and physical signs are sufficient on which to make a diagnosis.

Cholecystography is a test of function rather than an estimation of disease. The functions of the gall bladder of which this test is an estimate are the ability to receive bile from the liver by way of the cystic duct, to concentrate and absorb it, and to empty it. The accuracy of the method is estimated at from 89 to 91 per cent. It would appear that cholecystography, although useful, has its limitations, and should be used as an assistant method in the diagnosis of cholelithic disease where symptoms are not definite and the diagnosis is obscure. This is often the case in chronic cholecystitis without stone.

Blood chemistry is important. The estimation of blood bilirubin is just as important in certain cases of cholelithic disease as a blood sugar test is in pancreatic disease. Frequent records of the van den Bergh test, kept graphically, will reveal a bilirubin curve. In a rising curve, the danger from hemorrhage, in the case of operation, is indicated. A falling curve indicates greater safety in operation, the danger of hemorrhage being lessened.

I. J. CARTER, M.D.

Is a Diagnosis of Strawberry Gall Bladder Possible? A Clinical and Radiologic Study L. Feci and E. Ruggieri. *L'Ateneo Parmense* (Suppl.), 1931, III, 439-487

This is an exhaustive clinical and radiologic study of nine cases of strawberry gall bladder. Two distinct classes of facts are given consideration in the radiologic examination. Those which result from observation of the digestive tube (especially of the gastro-duodenal tract), and those resulting from the cholecystographic examination. These two classes of findings show mutual interdependence and complete each other.

It must in truth be recognized that in the majority of cases the Graham test attains its

maximum value insofar as the results are supported and strengthened by direct radiographic examination of the gastro duodenal tract. However, there no longer exists any doubt in the minds of investigators as to the necessity of this combined method of examination of the biliary channels.

The authors make no claim to a categorical solution of the difficult problem which they have undertaken, contenting themselves with mere presentation of the results of their investigations.

Clinically, the disease is encountered primarily in young women, and is of short duration. It shows generally a painful gastralgic, atypical symptomatology (continuous rather than periodic pain).

Radiologically, the syndrome is that of indirect cholecystitis, the Graham test shows signs of diminished resorptive activity (retardation, rarely absence of the appearance of the image), morphologic alterations (non-uniform pallor, blending and irregularity of outlines, deformations) and functionally the disappearance of the images more quickly than normally, at times very rapidly.

W. W. WHITELOCK, Ph.D.

The Intravenous Administration of the Gall-bladder Dye for Diagnosis G. T. Nordin. *The Journal-Lancet*, Jan. 15, 1931, LI, 41-43

Films are made previous to the administration of the dye to see if the gall bladder or stones will visualize. This is the most important part of the examination. The dye is then administered and films are made five or fifteen hours later. A fatty meal is then administered and films are made two hours later.

A gall bladder is considered normal if it is not visualized prior to dye, if it fills within five hours, and decreases to one-fourth its former size after the fatty meal. Any gall bladder visualized before dye is given is abnormal, whether or not it subsequently fills. In 281 cases, 270 were found to be pathologic from X-ray findings, 36 of these showed stones prior to dye, 67 showed stones after dye. At operation, 268 of the cases showed

pathologic gall bladders, of these 221 had stones Two patients were considered normal by the surgeon

W W WATKINS, M D

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

False Aneurysm of the Abdominal Aorta
W A Lincoln Canadian Med Assn Jour,
August, 1931, XXV, 197.

This is a case report of a patient, F B, a white male, aged 42, who had syphilis about twelve years before He had good health until nine months previous to examination, when he developed vague abdominal discomfort, gas, and indigestion About two months before, while pitching hay, he developed very severe pain in the left abdomen, running down into the leg, and collapsed for a few hours Examination at this time did not reveal any abnormality of the abdomen or left flank, and no definite diagnosis could be made About a month later he developed a mass in the left flank, which increased in size until it filled the whole left abdomen, protruding noticeably in the flank and a little behind it This extended up over the ribs and down to Poupart's ligament It had a decided cystic feeling and gave an expansile pulsation There was no bruit or thrill Pulsation was present in the tibialis, posterior tibial region There was no swelling or discoloration of the leg The Wassermann reaction was positive, blood count examination practically normal A pyelogram of the left kidney was normal, although the kidney was displaced upward A barium enema showed the colon to be normal and running over the top of the mass X-ray examination showed some erosion of the first three lumbar vertebrae The patient ran a slight temperature, suffered severely from a boring pain, and failed rather rapidly, dying from exhaustion about four months after the onset of the first pain

The postmortem examination revealed a large sac, practically filling the whole left side of the abdomen, with the colon lying over the top of it and the kidney pushed up in front and above The anterior and internal walls were very thick, while the outer and posterior

walls were formed by the body structures The sac contained nearly three quarts of clotted blood and a great deal of laminated clot There was erosion of the bodies of the first, second, and third lumbar vertebrae The opening from the aorta was clear-cut, measuring one and one-half inches across and came from the aorta behind and slightly above the left renal artery Sections of the aorta in this region showed slight fibrosis, but the remainder of the vessel was comparatively healthy

These cases are not very common Out of 18,000 autopsies at Guy's Hospital, there were 54 cases, and in 19,300 autopsies in Vienna, the condition occurred but three times

L J CARTER, MD

Further Observations on the Operability of Gastric Cancer from the Radiologic Point of View Alberto Anzilotti Minerva Med, May 26, 1931, XXII, 804-807

If the radiologic examination of a patient suffering from cancer of the stomach is to give a criterion of operability, it must furnish exact indications of the size and location of the tumor, of the conditions of the remaining parts of the stomach, and of the extent of the probable diffusion of neoplastic process to the surrounding organs The author thinks that up to the present time radiologic investigation is diagnostically helpful but not entirely sufficient

He reviews 148 cases of carcinoma of the stomach diagnosed during the last three years Although 35 of them were judged operable, only 21 were operated upon on account of poor general condition and the presence of other diseases Furthermore, in seven instances the surgeon had to limit himself to exploratory laparotomy, radiologic findings having failed to include metastatic involvement of hopeless extension Gastro-enterostomy was performed in fifteen additional cases as a palliative effort in relieving stenotic ectasia

The author reviews the radiologic signs leading to the diagnosis of cancer of the stomach, he agrees with Haudek upon the operability of the cancerous stomach which has preserved its hooked shape, and insists upon the importance of the study of the gastric

able one to make a diagnosis without laboratory tests, and will almost always attract our attention to this organ when not sufficient to convict it of harboring disease.

The physical examination may reveal much or little. In most cases the history and physical signs are sufficient on which to make a diagnosis.

Cholecystography is a test of function rather than an estimation of disease. The functions of the gall bladder of which this test is an estimate are the ability to receive bile from the liver by way of the cystic duct, to concentrate and absorb it, and to empty it. The accuracy of the method is estimated at from 89 to 94 per cent. It would appear that cholecystography, although useful, has its limitations, and should be used as an assistant method in the diagnosis of cholelithic disease where symptoms are not definite and the diagnosis is obscure. This is often the case in chronic cholecystitis without stone.

Blood chemistry is important. The estimation of blood bilirubin is just as important in certain cases of cholelithic disease as a blood sugar test is in pancreatic disease. Frequent records of the van den Bergh test, kept graphically, will reveal a bilirubin curve. In a rising curve, the danger from hemorrhage, in the case of operation, is indicated. A falling curve indicates greater safety in operation, the danger of hemorrhage being lessened.

L J CARTER, M D

Is a Diagnosis of Strawberry Gall Bladder Possible? A Clinical and Radiologic Study L Feci and E Ruggieri *L'Ateneo Parmense (Suppl.)*, 1931, III, 439-487

This is an exhaustive clinical and radiologic study of nine cases of strawberry gall bladder. Two distinct classes of facts are given consideration in the radiologic examination. Those which result from observation of the digestive tube (especially of the gastro-duodenal tract), and those resulting from the cholecystographic examination. These two classes of findings show mutual interdependence and complete each other.

It must in truth be recognized that in the majority of cases the Graham test attains its

maximum value insofar as the results are supported and strengthened by direct radiographic examination of the gastro-duodenal tract. However, there no longer exists any doubt in the minds of investigators as to the necessity of this combined method of examination of the biliary channels.

The authors make no claim to a categorical solution of the difficult problem which they have undertaken, contenting themselves with mere presentation of the results of their investigations.

Clinically, the disease is encountered primarily in young women, and is of short duration. It shows generally a painful gastralgic, atypical symptomatology (continuous rather than periodic pain).

Radiologically, the syndrome is that of indirect cholecystitis, the Graham test shows signs of diminished resorptive activity (retardation, rarely absence of the appearance of the image), morphologic alterations (non-uniform pallor, blending and irregularity of outlines, deformations) and functionally the disappearance of the images more quickly than normally, at times very rapidly.

W W WHITELOCK, Ph D

The Intravenous Administration of the Gall-bladder Dye for Diagnosis G T Nordin *The Journal-Lancet*, Jan. 15, 1931, LI, 41-43

Films are made previous to the administration of the dye to see if the gall bladder or stones will visualize. This is the most important part of the examination. The dye is then administered and films are made five or fifteen hours later. A fatty meal is then administered and films are made two hours later.

A gall bladder is considered normal if it is not visualized prior to dye, if it fills within five hours, and decreases to one-fourth its former size after the fatty meal. Any gall bladder visualized before dye is given is abnormal, whether or not it subsequently fills. In 281 cases, 270 were found to be pathologic from X-ray findings, 36 of these showed stones prior to dye, 67 showed stones after dye. At operation, 268 of the cases showed

fell into two classes—the secondary and the primary. Most of them belong to the latter class, in which the route of infection is most difficult or impossible to trace. Fifty cases have been reported of the secondary type, following such lesions as malignant or peptic ulcers, infected operation wounds in the stomach, or abscesses in adjacent tissues or organs.

The prognosis is extremely grave. Of all untreated cases, 92 per cent end fatally. In the three hospitals in which the authors' cases occurred, there are none on record, except those which came to autopsy.

Surgical treatment may cure some of the more accentuated cases. The operation is gastrostomy, gastro-enterostomy, jejunostomy, resection, or drainage of abscesses.

L J CARTER, M D

Acute Intestinal Obstruction, with Report of Cases (Mechanical Type) J A William Johnson *Jour Am Institute Homeop*, November, 1931, XXIV, 1138-1142

Acute intestinal obstruction may be external, internal, acquired, congenital, or traumatic. Internal obstruction occurs within the peritoneal cavity, and can be located only after opening the abdomen. External obstruction is most commonly exemplified by external hernia. Foster and Hausler maintain that there are two types of obstruction: acute simple obstruction and acute strangulation.

It is commonly accepted that the toxic element in bowel obstruction has its origin in protein decomposition in the bowel. Gatch, Trusler, and Ayers have shown that the toxic elements are caused by the bacterial action on the obstructed loop and are not absorbed by normal mucous membrane, but only after tissue necrosis occurs. Haden and Orr have further pointed out the loss of chlorides and the rise in non-protein nitrogen of the blood that occur in intestinal obstruction.

The early diagnosis of intestinal obstruction is of the greatest importance and, unfortunately, the symptoms are often recognized too late by the attending physician to be of any use in surgical treatment. The most dependable symptoms are as follows: vomiting, colicky or cramp-like pains visible, palpable,

or audible peristalsis, inability to expel gas and feces, and absence of temperature. The meteorism increases as the obstruction becomes lower, and vomiting increases as the obstruction becomes higher in the intestinal tract. Acute intestinal obstruction always begins with pain and is always followed by vomiting of pathognomonic character. According to Sampson Handley, fecal vomiting should be considered as a sign of impending death rather than a sign of obstruction.

The author believes that the early use of the X-ray will help reduce the high mortality in intestinal obstruction. Roentgen examination will give the characteristic reticulated appearance of the shadow cast by the gas-distended small bowel in cases of acute obstruction. A barium enema in this type of case will do no harm and will serve as a valuable aid in diagnosis.

In treating these cases it is commonly accepted that relief of the obstruction by surgical means is the first and most important consideration. The administration of sodium chloride by hypodermoclysis or by vein is essential, even before any operation is undertaken. This treatment makes a better operative risk and should be kept up post-operatively until the patient is out of danger. It is wise, likewise, to begin the intravenous administration of glucose early and continue until the patient can take food by mouth. The author includes several case reports of obstruction of different varieties.

J N ANÉ, M D

The Relationship of Disorders of the Digestive Tract to Anemia William B Castle, Clark W Heath, Maurice B Strauss, and Wilmot C Townsend *Jour Am Med Assn*, Sept 26, 1931, XCVII, 904-907

Anemia can presumably be produced either by an excessive loss or destruction of blood in the presence of a normally acting marrow, by a failure of the marrow to produce normal red blood cells in quality or quantity, or by a combination of these two factors.

If the food is to affect the bone marrow in some way, it is obvious that it must be absorbed from the gastro-intestinal tract. In

rugæ in the determination of the size of the lesion He mentions two cases personally observed and surgically confirmed in which a total spasm of the antrum, due respectively to superficial ulcer and chronic gastritis, led to the hypothesis of epithelioma, which was discarded later because a careful study of the rugæ revealed the presence of spastic process The difficulties encountered in the diagnosis of hepatic metastasis are pointed out by the author, who also states that one of the differential signs between ulcer and cancerous stenosis is to be found very often in the mechanism of digestion

L MARINELLI

Epigastric Hernia of the Stomach Osvaldo F Mazzini and Domingo Brachetto-Brian La Semana Méd, Sept. 10, 1931, XXXVIII, 807-809

Since epigastric gastroceles are so rare that only one case has been reported in the literature, the authors present such a case in which the diagnosis was made both clinically and radiologically

The hernia of this case was of eight years' duration and the size of a Brazil nut It was symptomless The lateral radiograph showed the gastrocele beautifully The patient was operated on and hernioplasty performed

N G GONZALEZ, MD

Phlegmonous Gastritis, with a Report of Four Cases J E Pritchard and J W McRoberts Canadian Med Assn Jour, August, 1931, XXV, 183-187

Within the last three years four cases of phlegmonous gastritis have been met with in the postmortem services of the Montreal General, the Royal Victoria, and the Notre Dame Hospitals of Montreal

The first case, a male, aged 19 years, had severe cramp-like pains in the epigastrium, immediately followed by vomiting The tentative diagnosis was perforated peptic ulcer At operation a thick greenish purulent fluid was seen to flow from the subhepatic region, a culture of which revealed hemolytic streptococci At autopsy the stomach was large and dark reddish-brown in color There were nu-

merous subperitoneal hemorrhages over the whole surface, most marked along the greater curvature The wall throughout was boggy, edematous, and markedly thickened The mucosa was covered with grayish, turbid fluid, containing fine granular suspensions The normal rugæ of the mucosa had disappeared and were replaced from the cardia to the pylorus by deep longitudinal troughs Microscopic sections proved that the thickening of the wall was mostly the result of a marked edematous swelling of the submucosa. Scattered diffusely throughout and extending between the bundles of the muscular coat were abundant leukocytes (pus) The mucosa was relatively well preserved, with a much slighter infiltration of leukocytes Sections through the pylorus showed a much more advanced involvement of the submucosa and muscular coats by the leukocytes, with necrotic fusion resembling an abscess The anatomic diagnosis was phlegmonous gastritis, with exudative purulent peritonitis

Cases 2, 3, and 4 were all discovered at autopsy The anatomic and microscopic findings were the same as in the first case Smears from the stomach wall and from the exudate showed abundant streptococci in all of them

The authors review the literature of this condition Although nearly always fatal, there have been some cases of phlegmonous gastritis cured by surgical treatment The disease, therefore, occasionally presents a diagnostic problem of importance It is a rare condition and is not often diagnosed before the abdomen is opened

In 1919, Sundberg reviewed 215 cases Gerster, in 1927, collected 48 additional cases Since 1927, some 22 additional cases have appeared in the literature

Of the four cases reported by the authors, one was the second case encountered in 4,188 autopsies at the Royal Victoria Hospital in the past twenty years At the Montreal General Hospital there have been observed four cases, including 2 and 3 of this series, among 9,300 autopsies in the past thirty-four years Case 4 is the only one on record at Notre Dame Hospital

Concerning the mode of infection, the cases

cholecystostomy, although primarily an operation of necessity, is nevertheless also valuable in cases susceptible to treatment (chronic cephalo-pancreatitis, for example), provided that they fulfill the requirements of a small stoma, and are permeable and as continent as possible, as shown by the radiographs in two of the observations. A large stoma, as seen in one of the observations, may give rise to dilatations by way of the biliary channels, with the danger of retrograde infection of the same.

From this it follows, other things being equal, and given the greater septic content which forms gradually in anastomosis with the involved segments of the intestine, that cholecystostomy offers a greater guaranty of sterility and from this point of view shows its superiority to other procedures.

W W WHITELOCK, Ph D

A Case of Ileo-ceco-colic Invagination
Guido Piccinino Archivio di Radiologia,
May-June, 1931, VII, 480-489

The author reports a case in which there were present all the radiological signs of ileoceco-colic invagination, which he gives in detail. At operation there was found no invagination but an adenocarcinoma of the cecum. He advises great caution in elaborating theories of the causation of this lesion, and, in making a diagnosis of it, he advises examination with barium given by mouth and by enema in order to eliminate the possibility that a tumor causes the invagination.

E T LEDDY, M D

Improved Method for Roentgen Examination of the Colon P C Schnoebelen Jour Mo Med Assn, November, 1931, XXVIII, 539, 540

This method consists of the introduction of 8 ounces of barium sulphate suspension into the rectum, the first film being made in five minutes. After part of the injected solution is expelled, a second film is made. Then all of the suspension possible is expelled and a third film made. Normal behavior is for all the barium suspension to remain in the pouch for the first film and to be entirely expelled

as shown by the third film. Rectal constipation is inability to empty the pouch. If the barium leaves the pouch and passes through the sigmoid, abnormality is present. The barium will ascend to an obstruction and outline its distal surface, it will also outline the narrowed canal of a partial obstruction. The fluoroscopic examination is made and correlated with the film findings.

W W WATKINS, M D

**GENITO-URINARY TRACT
(DIAGNOSIS)**

Congenital Bilateral Uretero-vesical Junction Stricture in Infants and Children
Meredith F Campbell Jour Urol, October, 1931, XXVI, 529-546

Congenital ureteral strictures occur in approximately 1 per cent of all individuals, are found most often at the uretero-vesical or uretero-pelvic junctions, and may be multiple as well as bilateral. When stricture is bilateral, the ultimate development of bilateral renal infection is inevitable and this, together with the symptoms caused by renal insufficiency, constitutes the clinical picture. This article is concerned only with bilateral congenital uretero-vesical junction stricture. The diagnosis is easily made by urologic examination. While removal of the obstruction is the usual indicated treatment, occasionally nephrectomy is demanded. The author reports on fifteen cases of this lesion. The ages of the clinical cases vary from two months to eleven years, the four autopsy cases included ranged from stillbirth to six months.

The embryologic etiology of congenital ureteral stricture is unknown. Apparently the incidence is higher in females. The micropathology of the stricture varies depending upon the amount of fibrous tissue and the presence or absence of inflammation. There is no evidence to indicate that localized muscular hypertrophy is the cause of the ureteral atresia in these cases. The changes in the upper urinary tract are quite the same, irrespective of the character of the ureteral blockade. The ureters and pelvis are dilated, bilateral hy-

general, it can be shown that patients with diarrhea are more prone to develop anemia than patients without diarrhea. Liver extract administered by daily intramuscular injection to patients with pernicious anemia is many times as effective as when given by mouth. This may indicate that difficulty with the assimilation of hematopoietic substances from the gastro-intestinal tract has a bearing on the etiology of pernicious anemia.

Pernicious anemia is a deficiency disease, resulting not from a direct inadequacy of the diet but from a conditioned deficiency produced by the failure of some function of the normal stomach to take place in the stomach of a patient with pernicious anemia. This reaction in normal individuals, they believe, has to do with the manipulation of protein and leads to the absorption of a factor necessary for the maintenance of normal bone-marrow activity. In general, disturbances of the gastro-intestinal tract of various kinds may interfere with absorption or with processes necessary for the proper metabolism of food substances essential for the normal functioning of bone marrow. In this way, even in the presence of a normal diet, disturbances of the digestive tract may condition a deficiency of nutrition, in particular of substances essential for blood formation.

C G SUTHERLAND, M B (Tor)

The "Common Mesentery" from the Surgical Point of View A Zaffagnini L'Ateneo Parmense (Suppl), 1931, III, 59-83

We may speak of a "common mesentery" whenever in the living subject there is encountered a doubling of the parietal peritoneum, common to the small and to the proximate portions of the great intestine, and which, permitting excessive mobility to the latter, is associated in greater or lesser degree with abnormal rotation.

Thus defined, a common mesentery is a fairly rare anomaly and one which shows no predilection as regards the sexes. In the radiologic picture of the anomaly, as gathered from the examinations which have been made, the stomach, which is normally placed, is fol-

lowed by the duodenum, which at times has a normal aspect, course, and fixity, but which more often is mobile and situated to the right of the median line. The small intestine is entirely dislocated in the right half of the abdomen and maintains this condition no matter what position the patient is made to assume. The ileac loop, running from right to left, enters the cecum, is generally very mobile and also very low, approximately behind the pubis. The colon is a twisted mass in the right half of the abdomen, and while the splenic angle, the descending colon, and sigma are in place, the ascending and transverse segments show numerous convolutions in the left half of the abdominal cavity, giving thus the impression of an abnormally long distention of the transverse. All the portions of the colon in front of the splenic angle are very mobile, so that the enema in distending the colon may expel portions of it into the half of the abdomen.

The author studied five cases of common mesentery, clinically and radiologically, only one of which came to operation, with a doubtful diagnosis fluctuating between appendicitis and peritoneal tuberculosis. Knowledge of the condition, he concludes, is of genuine importance to the surgeon, not only because of the complications to which it may give rise (volvulus, invagination, etc.), but also because of the morbid conditions frequently associated with it (appendicitis, cholecystitis, gastroduodenal ulcer, etc.). These conditions, due to the presence of the congenital malformation, assume a graver course, probably because the latter creates a *locus minoris resistentiae*.

W W WHITELOCK, Ph D

Enterobiliary Anastomosis, with Special Reference to Cholecystostomy A Zaffagnini L'Ateneo Parmense (Suppl), 1931, III, 324-355

After passing in review the various experimental stages through which the problem of enterobiliary anastomosis has passed, especially as regards cholecystostomy, the author reports five cases which were subjected to this operation. There was radiologic control of three of the cases not less than twenty months after operation. He concludes that

heavy load on the kidneys. The urine remains normal and the kidneys of laboratory animals do not show any pathologic lesions other than at times a slight cloudy swelling. The iodine content of skiodan is high, 52 per cent, but the iodine is in firm combination and is not set free in the urine.

Little preliminary preparation of the patient is necessary. A good cathartic is given the night before, followed by an enema in the morning. Twenty or twenty-five grams of the drug are dissolved in 100 c.c. of double distilled water. The solution is then filtered twice and is sterilized in an autoclave for 20 minutes at 15 pounds pressure. The solution is then cooled to body temperature and is injected into the median cephalic or basilic vein. There have not been any general reactions whatsoever, and, provided that all the solution went into the vein, there were no local reactions.

The first film is taken ten minutes after the injection, and one every 15 minutes for the next hour. From then on, films are taken depending on the excretion of the drug.

The only contra-indication to the use of the drug is severe impairment of the function of the kidneys.

A number of excellent reproductions of films showing such conditions as hydronephrosis, hydro-ureter, destroyed kidney, accompany the contribution of the authors.

L J CARTER, M D

Roentgen Diagnosis in Intravenous Pyelography Jesse J Peters Med Bull Veterans' Administration, October, 1931, VII, 918-921

The author reviews the history of intravenous pyelography and discusses the preparation and use of uroselectan in the study of pathologic conditions of the urinary tract. Intravenous pyelography offers a simple, painless method of examining the kidney pelvis, ureters, and bladder, radiographically producing urographs of diagnostic quality. This method does not replace retrograde pyelography, but should serve as an aid to determine function in surgical kidneys. In those cases, however, in which cystoscopy is difficult or impossible the intravenous method will be found most useful.

It offers valuable aid to the following, heretofore denied this important diagnostic aid: (1) Infants and children, (2) debilitated adults, (3) urethral stricture cases, (4) cases with deformities, (5) certain malignant cases. It is the method of choice in the absence of a competent urologist.

Hydronephrosis is probably the most commonly met pathologic change in the kidney. In those cases a careful study of the urographic findings should be made. Mechanical obstruction high in the ureter shows the pelvis greatly enlarged, with a flattening of the renal papillæ. On the other hand, obstructions lower in the ureter dilate the ureter and pelvis but very frequently do not involve the minor calices. Dilatations due to infections are generally less extensive than those of a purely mechanical nature and are more prone to distortions and irregularities in contour, due to the reaction of the renal epithelium.

J N ANÉ, M D

Ureterography in Some Blennorrhagic Sequelæ and in "False Passages" L Brunetti. Archivio di Radiologia, May-June, 1931, VII, 445-465

The author reports some ureterographic studies in a score of patients with sequelæ of gonorrhea. In his discussion of the normal and pathologic anatomy of the urethra, he advances some of his own views on the value of X-ray examination of it. In two cases of traumatic false passage he demonstrated its location and extent by injection of lithium iodide. An extensive bibliography on radiography of the urethra is appended.

E T LEDDY, M D

Cortical Adrenal Tumor Hunter, McMillan, Boyd, and Cameron Canadian Med Assn Jour, August, 1931, XXV, 188-193

Hunter reported, at a clinical conference, the case of a female, aged 30, admitted to the Winnipeg General Hospital, complaining of weakness, loss of weight, pain in the back, amenorrhea, shortness of breath, and swelling of the feet and legs. She had been a patient in the outdoor department about a year and a

dronephrosis may be extreme. The parenchyma shows compression nephritis and, usually, infection. If the child lives, urinary infection eventually occurs in all these cases. With the advent of infection, the upper tract pathologic process is intensified, and with advancing bilateral renal damage the signs and symptoms of uremia or urinary sepsis occur.

The late results of urinary back pressure plus infection are found in the elongated, angulated, tortuous, atonic, scarred ureters and in the thinned, sclerosed, and infiltrated renal tissue.

The clinical picture is the summation of symptoms due to infection and obstruction. Of the objective symptoms, persistent pyuria and the indication for urologic examination are outstanding.

Commonly accompanying pyuria are gastrointestinal upsets, low-grade fever, anemia, malaise, loss of weight or failure to gain, and pain due to the hydronephrotic distention. Secondary symptoms due to inflammation of the vesical outlet may be present. Marked diminution of renal function presents the usual train of uremic symptoms.

Urologic examination should include urinalysis, blood chemistry, two-hour phenolsulfonphthalein test, plain roentgenogram of the urinary tract, cystogram, cystoscopy, ureteral catheterization, divided renal function tests and, usually, pyelography.

In bilateral ureteral vesical junction stricture two findings are characteristic: (1) Difficulty in or impossibility of passing No. 4 F catheter into the ureters until the second or third examination. Upon withdrawing the catheter there is tightening of the ureter and a grasping of the catheter similar to that which occurs in urethral stricture upon the passage of a sound. Having introduced the catheter, a steady ureteral drip, characteristic of hydronephrosis, is obtained. (2) The pyelogram reveals a dilated ureter beginning in the strictured area and terminating in a hydronephrotic renal pelvis. Intravenous pyelography has not served as efficiently as the retrograde method in this type of cases.

Eradication of the obstruction is the treatment. In six of the patients gradual catheter dilatation was utilized. In the author's ex-

perience these strictures recontract rather rapidly. While marked diminution in pyuria and infection have consistently followed this treatment, in no instance has there been a bacteriologic cure.

Failing to obtain satisfactory dilatation by cystoscopic methods, open operation (transvesical ureteral meatotomy and stricture section) may be resorted to. In extremely ill patients with low renal function, preliminary bilateral ureterostomy drainage is indicated, followed by the necessary surgical measures after the renal function has been sufficiently restored. Unilateral renal damage and infection may be so extensive as to require nephrectomy. Occasionally resection and transplantation of the dilated atonic ureter may be necessary, although this is productive of ureteral regurgitation.

This study serves to re-emphasize the importance of complete urologic examination in children when pyuria—usually diagnosed as chronic pyelitis—exists. While operative treatment cannot always offer a complete cure, surgical results exceed those obtained by any other method. Medical therapy alone is inadequate, with continued back-pressure, renal destruction and uremic death may be anticipated.

A liberal number of roentgenograms and illustrations of this pathologic condition accompany the article.

DAVIS H. PARDOLL, M.D.

Intravenous Pyelography with Skiodan A Brief Clinical Report David W. MacKenzie and Max Ratner Canadian Med Assn Jour, August, 1931, XXV, 172-174

The introduction of uroselectan for intravenous pyelography by Swick and von Lichtenberg has proved to be an invaluable aid in the diagnosis of genito-urinary disease. The drug is a popular one and is being used extensively all over the world. Since April, 1931, the authors have been using a new drug, skiodan, which has proven a safe and reliable medium.

The drug is a very efficient diuretic and the rate of excretion is high. In spite of this rapid excretion the drug does not throw a

vesicles, vasa, right kidney, lungs, fifth lumbar vertebra, and lymph nodes. The third was a squamous-cell carcinoma of the cervix which metastasized to the right ureter, liver, and mesenteric lymph glands. In 1927, Carson reported two additional cases. The first was a carcinoma of the prostate which metastasized to the right ureter, bladder, seminal vesicles, lumbar vertebræ, and mesenteric lymph nodes. The second was a carcinoma of the prostate which metastasized to the right ureter, bladder, seminal vesicles, right kidney, pelvis, lungs, and lymph nodes.

Rathbun, in 1929, described a single case. The patient, a male, had metastasis in the left ureter, secondary to scirrhous carcinoma of the left breast, which had been removed three years previously.

The authors carefully reviewed all the cases with lesions of the ureter that have been met with in the Departments of Urology and Pathology at the Royal Victoria Hospital, Montreal. They found three cases of metastatic growths, thus making a total of eleven authentic cases.

Of the three cases found, one was in a female and two in males. The female was 34 years of age, and the males 45 and 61. Both the male cases came to autopsy, and the diagnosis was made on the postmortem table. The female patient is still alive. The diagnosis in her case was made at operation. The first patient came into the hospital complaining of shortness of breath, palpitation, swelling of the legs, cough, bloody expectoration, and slight nocturnal urinary frequency. The symptoms had been of one year's duration. The clinical diagnosis was chronic nephritis, aortitis, and chronic myocarditis, with decompensation. The patient died 48 hours after admission to the hospital. The postmortem findings were adenocarcinoma of the prostate, with metastases in the ureters, lungs, and lymph glands, bilateral hydronephrosis, hypertrophy of the heart, arteriosclerosis, dilatation of the first part of the aorta. Although the patient died from carcinoma of the prostate, with multiple metastases, yet the clinical picture was that of cardiac failure and renal insufficiency.

The second case was one of carcinoma of the stomach. There were no symptoms referable to the urinary tract, yet the postmortem examination revealed metastatic growths in the right ureter.

The third case was discovered on the operating table. A carcinoma of the cervix had been treated by radium a year previously, with apparently good results. One year after treatment the patient began to complain of severe pain in the left loin, radiating down and forward, frequency of urination, anorexia, and loss of weight. A clinical diagnosis was made of an obstructed ureter, with a left hydro-nephrosis. The patient was operated upon and a nephrectomy and partial left ureterectomy were done. The anatomical diagnosis was carcinoma of the ureter secondary to carcinoma of the cervix.

In summarizing their contribution, the authors note that the diagnosis of a newgrowth of the ureter, whether primary or secondary, is made almost always at operation or on the autopsy table. There are no signs or symptoms which are pathognomonic, and the condition is rarely considered. The outstanding symptom is pain. This may be represented by a dull steady ache on one or the other side, or may simulate a severe renal or ureteral colic. Hematuria is a variable symptom. In primary growths it occurs at one time or another during the course of the disease, and may be profuse or very scanty. In metastatic growths, on the other hand, hematuria will not occur unless the growth has encroached on the lumen of the ureter. Frequency, urgency, and dysuria are occasionally complained of, and usually result from a secondary infected hydronephrosis and hydro-ureter. Cystoscopy gives the most information.

L J CARTER, M.D.

Foreign Body in the Abdomen as a Result of Attempt at Abortion Localized by X-ray
Dino Agati Archivio di Radiologia, May-June, 1931, VII, 466-472

This is a case report of attempted abortion by means of a catheter introduced into the uterus. The uterine wall was ruptured, and there was found on X-ray examination an

half previously, when a tentative diagnosis of chronic glomerular nephritis was made

He indicates that the diagnosis should be obvious from a study of the clinical history and an ordinary physical examination. This is emphasized in view of the modern tendency to substitute laboratory diagnosis for the safer but more time-consuming bed-side examination. When menstruation disappears, when hair of the masculine type of distribution develops profusely in a young woman of buffalo-like disproportion of shoulder and buttock, who exhibits a large tumor in the renal region and a hypertrophied clitoris, tumor of the adrenal cortex is the probable diagnosis.

McMillan gave the X-ray findings as follows. The right diaphragm is elevated, being one and one-half interspaces higher than the left. It has the normal curve, which would suggest that the displacement is due to some intra-abdominal pressure. There is a clear-cut, circular, opaque area in the lower part of the right chest, just above the diaphragm, which has very much the appearance of a metastatic lesion from a malignant kidney. There is marked decalcification of the bodies of the last dorsal and all the lumbar vertebrae. The bodies of these vertebrae are more or less collapsed, the third being the least deformed. The left kidney shadow is distinctly seen, but the right is not. There is a small circular shadow superimposed on the ninth rib posteriorly, and well out from the midline. A pyelogram made on the right side shows the pelvis and calices to be well visualized. The kidney is apparently displaced downward and the upper pole rotated outward. The upper calyx shows some deformity.

Boyd reported on the pathologic examination of the tumor removed from the vaginal wall, which resembled tumors of the adrenal cortex.

Cameron discussed tumors of the adrenal cortex and their effect in producing the sex changes noted.

L J CARTER, M D

Max Ratner Canadian Med Assn Jour, September, 1931, XXV, 265-270

Pathologic lesions that are of rare occurrence, and usually diagnosed at the autopsy examination or in the operating room, always stimulate interest and discussion. Metastatic growths of the ureter belong to this class, and lately the authors encountered such a condition. They review the literature and collect other similar cases that have been met with at the Royal Victoria Hospital.

Newgrowths of the ureter, whether primary or metastatic, are extremely rare occurrences, the former appears to be the commoner of the two. Although only 59 cases of primary growths of the ureter are reported, yet an appreciable amount of literature has been written on the subject. On the other hand, very little has been published on metastatic growths of that organ. Up to December, 1930, only eight authentic cases could be found in the literature.

It is of extreme importance to emphasize that under the heading of metastatic growths of the ureter are included only those lesions that have been proved definitely to be the result of metastasis conveyed to the ureter by lymphatics or blood vessels. Secondary growths of the ureter, due to direct extension of tumors of adjacent organs, such as the uterus, bladder, or kidneys, are not true metastases, and are not included, therefore, in this class. Moreover, in order to prove that a secondary growth is a true metastatic one, malignant cells must be demonstrated in the perivascular lymphatic spaces or blood vessels of the ureter.

The first authentic case of a metastatic growth of the ureter was reported by Giordano and Bumpus, in 1922. This was a carcinoma of the prostate which had metastasized to the left ureter, left renal pelvis, lungs, and left kidney.

In 1925, Carson added three more cases to the literature. The first was that of a man with a carcinoma of the bladder which metastasized to both ureters, prostate, mesenteric lymph nodes, lumbar vertebrae, and liver. The second had an adenoma of the prostate with metastasis to the right ureter, bladder, seminal

done Examination of the removed kidney by the pathologist revealed nothing more than a slightly dilated pelvis, and a small scar in the cortex which suggested a healed inflammation The patient has been perfectly well ever since

Case 3 A woman of 57 was admitted suffering from attacks of pain in the left lower quadrant, associated with frequency of urination Cystoscopy showed a normal condition of the bladder and ureters The diagnosis was peritoneal adhesions, causing intermittent hydronephrosis and pyelonephritis A laparotomy was advised but the patient did not consent Six months later the patient returned with the condition unimproved Cystoscopy again was normal for urogram of the left kidney and ureter At operation the sigmoid was found adherent to the base of the broad ligament, posteriorly The lesions were removed and the uterus suspended to the anterior abdominal wall The ureter was palpated and appeared to be normal The patient has been perfectly well in the two years that have elapsed since the operation

L J CARTER, M D

Criteria of Interpretation and a Critical Evaluation of Intravenous Pyelography
Mario Luigi Asti Archivio di Radiologia, May-June, 1931, VII, 589-604

The author reports some studies carried out with uroselectan and abrodil He points out the safety and advantages of this examination, but feels that incorrect interpretation of the findings may lead to grave diagnostic errors He shows that ascending pyelography is still a method of the greatest importance

E T LEDDY, M D

A Case of Bilateral Hydronephrosis, Pyelonephritis, and Kinked Ureters, Treated by Bilateral Nephrostomy, Demonstrating the Recovery Phase in the Pathological Physiology of the Ureter Channing S Swan Urol and Cutan Rev, November, 1931, XXXV, 713-715

It has been demonstrated that as a result of partial obstruction of the ureter hypertrophy and hyperplasia of the musculature, elongation, tortuosity, and dilatation of the ureter de-

veloped A similar reaction is noted in pregnancy, as a result of pressure on the ureter by the enlarging uterus Crabtree demonstrated that in the average normal case the ureter returned to normal in three months postpartum Quinby stated further that mere infection of the ureter without pregnancy or obstruction would produce similar changes He also believed that the ureter would return to normal after the infection had been cleared up, if there was not too severe a degree of peri-ureteritis fixing the organ in its snake-like position From one to two years was considered the recovery time, as demonstrated by the X-ray

The author's patient, a woman 52 years of age, and the mother of thirteen children, complained of pain of six months' duration in the left kidney region When first seen she was vomiting, and there was tenderness and the question of a mass in the left kidney region A pyelo-ureterogram showed a kinked left ureter and a left hydronephrosis The temperature, pulse, and respirations were elevated The day after admission she complained of pain in the right kidney region Pyelography revealed a tortuous kinked ureter and a mild hydronephrosis on the right, similar, but less marked, to that on the left About one week subsequent to admission a left nephrostomy was performed under local anesthesia, twenty days later nephrostomy being done on the right kidney The right nephrostomy was permitted to heal in ten days, but the left side was kept open

Three months after her original entry she returned for observation Pyelo-ureterograms revealed normal ureters and practically normal renal pelvis The left nephrostomy was then allowed to heal Further observations showed complete recovery from the urologic condition The author believes that this case demonstrates the power of the ureter to recover anatomically and physiologically from the elongation and tortuosities which come with infection

J N ANE, M D

The Radiologic Findings in Cystic Dilatation of the Lower End of the Ureter as

opaque catheter—a Gregory No 10—lying almost completely inside the peritoneal cavity. Following laparotomy and removal of the foreign body, the patient made a smooth convalescence. The author emphasizes the importance of X-ray examination in cases with obscure objective signs and subjective symptoms, as in this patient.

E T LEDDY, M D

The Effect of Peritoneal Adhesions upon the Urinary Tract Frank S Patch and Merle D Evans Canadian Med Assn Jour, October, 1931, XXV, 399-401

Obstructions of any part of the urinary tract by lesions outside it constitute an interesting chapter in urology. Examples of this are constantly to be found in connection with the genital organs of the female, as displacements and tumors of the uterus, inflammatory deposits in the parametrium affecting the bladder, and, in both sexes, malignant metastatic growths in the pelvis, profoundly affecting the ureters and kidneys. Urologic textbooks only occasionally deal with this type of lesion. We have not observed any reference to the effect of peritoneal adhesions in producing ureteral obstruction. It appears to us, however, that the lesion is much more common than this would indicate, and that the possibility of its occurrence should be borne in mind by urologists in cases of hydronephrosis in which no other etiologic factor can be found. Three cases of this sort have been observed in the urologic service of the Montreal General Hospital, and are here reported in detail.

The three cases differ markedly in various respects. The first was an accidental autopsy finding which furnished definite proof that the lesion produced almost complete destruction of the kidney above the obstruction. The other cases were clinical observations, with markedly contrasted therapy, in one case radical, in the other conservative.

Case 1 A married woman, aged 67, was admitted with a history of frequency of micturition and incontinence of urine. She was found to have residual urine of 2,230 cubic centimeters. The specific gravity of the urine was 1,020, reaction alkaline, and it contained

albumin, pus, and red blood cells. X-ray examination of the genito-urinary tract was negative. Cystoscopy showed the capacity of the bladder to be reduced. The bladder wall was friable and covered with an adherent slough, gangrenous in character. The ureteral orifices could not be seen. Cystostomy was done and drainage was effected by a Freyer tube. There was slight temporary improvement, followed by a lapse into unconsciousness and death. Autopsy showed a gangrenous cystitis. The left ureter and kidney were normal, the right ureter and kidney were greatly dilated and filled with a dark foul-smelling material. The kidney cortex was much inflamed. The point of interest, and the one accounting for the right pyo-ureter and right pyo-nephrosis, was found in several pelvic adhesions, one of which ran from the postero-lateral border of the right broad ligament to the peritoneum just beyond the sacro-iliac synchondrosis. This band crossed the ureter close to the bladder and tightly compressed it, leaving a distinct furrow below which the ureter was of normal caliber, immediately above it the ureter was widely dilated.

Case 2 A man aged 54 had suffered repeated attacks of pain in the left lower quadrant of the abdomen. These attacks had been present off and on since an abdominal operation in 1919, for a supposed abdominal tumor. In 1923, the abdomen was opened for adhesions, but without relief. The pains were colicky in nature and accompanied by nausea and a desire to urinate, which act gave relief. Cystoscopy showed a smaller left ureteral orifice, and there was a suggestion of ureteral narrowing but no hydronephrosis. The ureter was dilated to No 11 Fr on several occasions, without relief. The abdomen was opened and numerous adhesions in the left lower quadrant were separated with difficulty. The patient remained well for a year, when the pains again returned. Pyelography showed a normal kidney. The abdomen was again opened and dense adhesions between the bowels, the pelvic walls, and the bladder were found impossible of removal. The attacks continuing, it was seen that nothing could be done but remove the apparently normal left kidney. This was

used, the author takes great pains in this article to describe the technical points which must be followed in order to obtain good results. He presents two cases of dilatation of the pelvis and ureters, due to pressure (pregnancy) in which resort was had to intravenous pyelography.

N G GONZALEZ, M D

Renal Carbuncle Albert R Fritz and Leo S Drexler Urol and Cutan Rev, November, 1931, XXXV, 703-705

Carbuncle of the kidney, described by Israel, in 1901, is considered rather rare, as a recent review of the literature by Moore revealed only 42 cases. The authors report an additional case and discuss the etiology, pathology, symptomatology, diagnosis, and treatment of renal carbuncle.

The patient, a boy, 18 years of age, complaining of pain in the right lumbar region associated with fever and general malaise, was admitted for hospitalization. His urine was persistently negative for pus or blood, and there were no urinary symptoms. History disclosed that the patient had been annoyed by pimples over his neck and back, which had subsided six weeks before the onset of the present illness. Physical examination revealed an acutely ill, emaciated individual, whose temperature was 99.2, pulse 86, and respiration 20. The abdomen was somewhat distended, but no masses were palpable. Cystoscopic examination was negative except for slight obstruction to the ureteral catheter high up on the right. Indigo carmine, injected intravenously, returned in three minutes on the left and in seven minutes on the right. Roentgenologic examination showed an enlarged right kidney. Pyelography revealed a moderate degree of pyelectasis on the right. The upper calyx was elongated and a large cystic dilatation, apparently communicating with the inferior major calyx, was noted and filled with the injected sodium iodide. The culture of urine from the right kidney was reported as *B. coli*. The blood examination showed 26,600 leukocytes, with 80 per cent polymorphonuclear cells. A diagnosis of renal carbuncle was made from the history and roent-

genologic findings, and the patient was operated on. The abscess was found well walled off, of considerable size, and bearing the typical appearance of a carbuncle as met with in other portions of the body. Nephrectomy was performed and the patient's convalescence was uneventful.

This condition was found to attack men more frequently than women, and the age limits in the reported cases range from 10 to 55 years. The original focus of the *Staphylococcus aureus*, the usual invader, is often considered trivial. Trauma is believed to be an important predisposing factor. The pathologic picture is usually confined to the cortex, although in some cases it may rupture into the capsule and produce a perinephritic abscess, or, rarely, it may involve the remainder of the kidney and drain through the pelvis and the ureter.

The onset is usually insidious with malaise, loss of appetite, and an intermittent fever. Leukocytosis, with counts from 10,000 to 25,000, is the rule. Pain, nausea, and vomiting are also encountered in some cases. The authors believe that the history of the case is the most important factor in the diagnosis. However, differentiation from an acute embolic metastatic kidney is difficult. Deformities in the renal pelvis and distention of the calices, as observed by pyelography, have been reported by Moore, Dick, and Horn. The distention of the pelvis, due to the pressure of the abscess, often suggests a renal neoplasm.

In the treatment of renal carbuncle, nephrectomy is believed to be the treatment of choice. In cases in which the carbuncle is small, resection has been recommended. Moore reported a case in which complete cure was obtained by the intravenous administration of mercurochrome.

J N ANÉ, M D

The Lateral Pyelogram A Neglected Procedure in the Diagnosis of Various Abdominal Conditions H O Mertz Jour Indiana St Med Assn, October 15, 1931, XXIV, 537-541

The technic of making a lateral pyelogram should be studied and worked out by each

Shown by Descending Pyelography Guerino Lenarduzzi Archivio di Radiologia, May-June, 1931, VII, 580-588

The author thinks that descending pyelography gives a complete pathognomonic picture of cystic dilatation of the ureter, because it gives natural filling of both the ureter and the bladder and so brings to light the real morphology of the two organs. Therefore, descending pyelography is superior to ascending pyelography in the study of this lesion.

E T LEDDY, M D

Traumatic Rupture of the Urinary Bladder Due to Fracture of the Pelvis Joseph A Lazarus Urol and Cutan Rev, December, 1931, XXXV, 761-764

Traumatic rupture of the urinary bladder results more frequently from external violence than internal forces, but both types of injury may serve as etiologic agents. Intra-peritoneal ruptures are more frequently encountered than the extra-peritoneal types. Since the traumatic force is most frequently directed to the lower abdominal wall, the rupture usually occurs in the upper median part of the bladder surface, a portion of the bladder usually covered by peritoneum. The entire thickness of the vesical wall is usually involved in a laceration of this viscus.

Extravasation of urine and infection are the most important complications of rupture of the urinary bladder. Hemorrhage rarely occurs and, when present, is not sufficient to endanger the life of the patient. In the intra-peritoneal type of rupture the results attending the extravasation depend mostly upon the character of the urine. Sterile urine leads to peritoneal irritation and peritonitis as a late complication. Diffuse peritonitis is generally the rule in cases of intra-peritoneal rupture of an infected bladder. In cases of extra-peritoneal rupture, the tissues affected by the extravasation depend directly upon the position of the laceration. Cellulitis, with abscess formation, may result from superimposed infection of the extravasated urine.

Immediately following rupture of the bladder the patient is usually in shock. Pain, tenderness, hematuria, toxemia, and inability to void are characteristic symptoms in all cases.

of vesical laceration. Pain is present in all cases, accompanied by vomiting and distention in those cases in which the extravasation is intra-peritoneal. Fever occurs with the onset of infection. In untreated cases intoxication results from absorption and infection, frequently terminating in uremia and death.

In some cases the diagnosis may be made from the history alone. Vaughn and Rudnick advise the injection of a small amount of air into the bladder while the patient is under the fluoroscope. The association of rupture of the bladder and fracture of the pelvis is always serious because of the possibility of osteomyelitis.

The treatment of rupture of the urinary bladder is always surgical and consists of the eradication of the sinus tracts and repair of the rent itself. The average mortality resulting from surgical treatment of intra-peritoneal rupture of the bladder, as compiled by Young, from various clinics, is 51 per cent.

The author presents the case of a female child, two and one-half years old, who presented a fistulous urinary tract opening on the upper and inner aspect of the right thigh. There was likewise a free escape of urine through the vagina. Six months previously the patient had sustained a fracture of the pelvis as the result of an accident. At the time of examination by the author, a cystogram, taken after the injection of opaque medium through the sinus of the right thigh, outlined the fistulous tract extending along the right pubic bone into the bladder. The bladder appeared thickened and trabeculated. At operation the bladder wall was found greatly thickened and the vesical cavity contained a large quantity of necrotic and calcareous material. After surgical treatment the patient made an uneventful recovery.

J N ANÉ, M D

Pyelography by Descending Route Carlos Heuser La Semana Méd, Sept 10, 1931, XXXVIII, 851-855

Since many reports have come out in the literature concerning poor results obtained from intravenous pyelography, particularly in cases in which uroselectan and abrodil are

portance of congenital strictures of the ureter should be remembered also

Ureteral conditions may give rise to many symptoms in organs quite unrelated to the genito-urinary tract. A number of patients, especially women, have persistent and obscure gastro-intestinal symptoms with negative gastric analyses. Many of these patients are operated upon for various gastro-intestinal conditions, and experience no relief after the operation. Usually after considerable study, evidences of hydronephrosis are found, and the patients find themselves free of symptoms after dilatation of the involved ureter.

While the majority of ureteral calculi have their origin in the kidney, the author believes that constriction and obstruction of the ureter offer very favorable conditions for the production of calculi directly at the site of the lesion. Ureteral fibrosis may precede or cause the stone, or may be extended by a stone descending from the kidneys, and arrested by a pre-existing soft stricture.

The author concludes that all vague abdominal pain, gastro-intestinal symptoms, and obstinate backache should be carefully considered and studied by the internist, the pathologist, the roentgenologist and the urologist all working together in mutual co-operation.

J N ANÉ, M D

Hydrosalpinx Its Visualization by Hysterosalpingography Albert Mathieu Calif and West Med, August, 1931, XXXV, 73-78

In discussing hydrosalpinx, the author depends a great deal on iodized oil and the X-ray findings for diagnosis. He discusses the various types of hydrosalpinx, namely, those with closure of the proximal end of the tube, with closure of the distal end, and with closure of both ends.

In discussing the etiology, he believes that most of these are due to gonorrhreal infections. However, some of them may be due to tuberculous or pyogenic streptococcus infection. From the history it is probable that the husband has infected his wife with an attenuated gonococcus, he having thought himself cured and married prematurely. The author

illustrates his article with many X-ray reproductions.

FRANCIS B SHELDON, M D

GENITO-URINARY TRACT (THERAPY)

Empyema of the Ureteral Stump Ralph L Dourmashkin Jour Urol, October, 1931, XXVI, 553-573

The writer employs the above term to designate a collection of thick pus within a dilated ureteral stump, following incomplete ureterectomy. The persistence of pyuria may follow non-tuberculous nephrectomies in which a diseased ureter has not been carefully followed down to the bladder and excised. Omission of proper care to the infected lower end of the ureter may lead to a condition described as empyema of the ureteral stump.

Since normal ureters rarely become infected following nephrectomy, it would seem that a requisite for an empyema of a ureter to develop would be a pre-existing diseased state of this organ.

The treatment consists of adequate drainage and lavage of the infected sac. If this is found impossible because of a stricture at the lower end of the ureter, the orifice may be enlarged by fulguration, or, finally, excision of the stump must be resorted to if the preceding therapy has been found inadequate.

The paper reviews several cases which are accompanied by roentgenograms illustrating the condition.

DAVIS H PARDOLL, M D

The Prostatic Problem John H Cunningham Canadian Med Assn Jour, October, 1931, XXV, 428-432

In considering the prostatic problem, the most important fact to be appreciated is that the prostate itself is but the primary factor producing urinary retention. The presence of this retention influences the activity of the kidneys, and, in consequence, reflects unfavorably upon the circulation. Thus, a medical aspect develops which becomes the most important part of the picture, and surgery is but the means of improving it. In view of our present knowledge of the requirements for pronounc-

cystoscopist and roentgenologist It will necessarily vary somewhat with each operator The usual cystoscopic table may be used, the side of the patient to be injected being next to the film The position must be exactly lateral An anteroposterior pyelogram is first made and studied, the patient's position being changed if a lateral view seems advisable Normally the shadow of the pelvis lies behind the second lumbar vertebra Congenital changes in the kidney and ureter, the orienting of densities suspected of being calculi, tumors in the kidney region, and many other conditions find an easier solution when a lateral pyelogram is taken in addition to the usual anteroposterior view

W W WATKINS, M D

Intravenous Pyelography Luigi Turano
Archivio di Radiologia, May-June, 1931, VII,
605-626

The author reviews 150 cases studied by him and brings out the advantages and limitations of the method in the study of various urologic conditions

E T LEDDY, M D

Diseases of the Biliary Tract Clinical and Surgical Aspects Claude F Dixon
Calf and West Med, July, 1931, XXXV,
1-5

The author comments on the literature and pathology of the diseases of the biliary tract He gives the various types and classifies these diseases, according to Judd and McIndoe, as follows (1) Acute cholecystitis, (2) metabolic cholecytic disease, with or without stones, and (3) clinical or functional cholecytic disease

Under metabolic cholecytic disease, with or without stones, is the so-called "strawberry gall bladder" In this the gall bladder may function normally and, unless the stone obstructs the cystic duct, there may be no symptoms

In the third group there may be typical symptoms yet no evidence of disease is found —either microscopically or grossly, yet relief is often had after removal of the gall bladder Cholecystography has been found a

great aid in the diagnosis of disease of the gall bladder The functional test should be used in corroboration with the clinical findings The most characteristic symptom of a diseased gall bladder is pain, and when this is present, removal of the organ gives permanent relief in the majority of cases

FRANCIS B SHELDON, M D

The Diagnostic Value of Intravenous Urography Bruno Bellucci Archivio di Radiologia, May-June, 1931, VII, 651-661

The author thinks that the greatest value of the method is in those cases in which the ascending method is contra-indicated or those in which its evidence needs supplementation or confirmation

E T LEDDY, M D

The Rôle of the Ureter in Lesions of the Upper Urinary Tract Solomon I Movitt Urol and Cutan Rev, October, 1931 XXXV, 647-649

The author is of the opinion that pathologic conditions of the ureter occur more commonly than the number of cases reported would lead one to believe From an anatomic standpoint the kidney pelvis is not an organ which sometimes fills up and at times empties itself It should be considered as a link between the kidney and the urine-conveying tract Hyer expressed the view that anatomically the renal pelvis is just the initial part of the urete which forms only an unnoticeable continuation of the pelvis

The points of interest in the physiology of the ureter, as mentioned by the author, are as follows (1) It is distensible, (2) it has natural points of constriction often accentuated under pathologic conditions, (3) it has mechanism at the ureteral orifice which prevents regurgitation from the bladder Wu slow and O'Connor, however, have demonstrated that in pathologic conditions reflux of urine can occur in man Hunner pointed out the significance of the ureter in the urinary system, and he also contended that focal infection should be considered as an etiologic agent in ureteritis and ureteral strictures The in-

vals of 15, 30, 60, and 90 minutes following completion of the injection

No alarming reactions were noted, though patients complained of a variety of minor symptoms. In only 18 cases were the results entirely satisfactory. In 13 cases, the upper urinary tract was not visualized, of these, final diagnoses were normal in 5, pyelonephritis (3), kidney tumor (2), perinephritic abscess (1), and renal tuberculosis (2).

W W WATKINS, M D

Ureteral Meatotomy A Clinical Evaluation
Neil S Moore Jour Urol, October, 1931, XXVI, 519-528

From a clinical and radiographic study of about seventy-five cases on which ureteral meatotomy had been performed, covering a period of seven years, the author feels justified in drawing the following conclusions:

(1) The operation, though comparatively minor, is technical and deserves just consideration.

(2) When properly applied, the high frequency meatome is effectual and safe. It is possible to continue work higher up the ureter at the same sitting. There should be no alarming complications.

(3) There has not been any stricture formation following the operation in any of the cases observed.

(4) In a clinical and radiographic study of a series of cases, and symptoms or signs of ureteral regurgitation, at any time following the operation, were absent.

(5) A number of cases have been found in which the ureteral opening was amply large to admit from seven to nine catheters after the passage of which there was temporary relief. The same cases have shown more permanent, if not definitely permanent relief following a good wide incision of the opening.

The writer has devised an instrument for performing the operation and illustrations of it are contained in the article.

DAVIS H PARDOLL, M D

Therapeutic Irradiation of the Ovaries
A C Siebert Calif and West Med, October, 1931, XXXV, 290

This paper takes up the therapeutic action

of roentgen rays and of radium when directed against the ovaries of women suffering from benign gynecologic affections, as well as from diseases remote from the sexual organs *per se*, but which are influenced by the ovaries. The opinions here presented are based on personal experience with some sixty patients.

The author then takes up the general considerations, such as the effect of ovarian activity on a healthy genital tract and the body generally, and the sensitivity to radiation of the epithelial constituents of the ovary, which is exceeded only by the lymphatic tissues.

In the use of radium for menostasis not over 800 milligram-hours should be used. For permanent amenorrhea the radium intrauterine dose must be from 1,200 to 1,800 milligram-hours, or from 35 to 40 per cent of a roentgen skin dose must be absorbed by the ovary. The best time for giving the dose is the first half of the intermenstrual period. In younger women the question of post-radiation pregnancy must be considered. This possibility is discussed by the author.

Under the heading of "Special Phases" he discusses the treatment of (1) *Benign uterine hemorrhage*, for which he prefers the roentgen ray. Good results, in his experience, measure up to a 100 per cent standard, provided the proper agent is used and an adequate dosage given. Contra-indications are uncertainty of diagnosis regarding the benign nature of the hemorrhage, the youth of the patient, extremely neurotic individuals and hypertension.

(2) *Painful menstruation*. Radiation menopause by means of the X-ray is justifiable if the patient has reached her fortieth year. The results in this case are very gratifying. Here the same contra-indications should be considered as given under "Benign hemorrhage."

(3) *Fibromyoma uteri*. Under this heading the question of whether the treatment should be given to the ovary or to the tumor alone is discussed. The author believes that the treatment should be directed to the ovaries. Here he gives as contra-indications the youth of the patient, acute and serious pressure symptoms, degeneration of myomas, pedunculated myomas, and infection, if acute. Sar-

ing a prostatic patient fit or unfit for surgical treatment, every patient with prostatic obstruction must be viewed in terms of renal and circulatory impairment, and should be given the advantages of most careful clinical and laboratory study to determine the best course to pursue

In order to give the general average of the prostatic patient, the author looked over his last 400 cases operated upon. The age varied from forty-four to eighty-nine years, and the greatest number of cases occurred between the ages of sixty and seventy. Associated defects were discovered as follows: Renal, over 90 per cent; circulatory, over 75 per cent; respiratory, over 20 per cent; nervous system over 25 per cent.

This great preponderance of renal and circulatory defects renders the determination of the condition of the kidneys and circulatory organs the most important feature of pre-operative study. Renal impairment will depend chiefly on the degree of the back pressure. This produces dilatation not only of the ureters but also of the kidney pelvis and calices, and a thinning of the renal cortex, whereby the secretory power of the kidneys is decreased. Infection superimposed upon these mechanical degenerative changes further diminishes efficiency of the kidneys. As a result of this diminished power of elimination of the kidneys, an increased burden is placed upon the heart. A definite cardio-renal complex and a varying degree of toxicity develop insidiously, with an abnormal nitrogen retention, and uremia is an inevitable consequence.

The deaths from prostatectomy, in olden days, occurred mostly from uremia, occasionally from sepsis, and, rarely, from hemorrhage. The mortality to-day depends upon the same factors, but much may be accomplished by pre-operative treatment in overcoming uremia and sepsis. As a consequence, the mortality has changed from about 30 per cent, twenty years ago, to about 5 per cent at the present time.

Bladder drainage is the most important feature of pre-operative treatment and is the means to the end of permitting the forcing of

fluids and an estimation of the recuperative powers of the individual.

The author goes into the details of operative treatment for the various types of prostatic obstruction, the nature and extent of the operation depending on the nature of the obstruction and the condition of the patient.

In cancer of the prostate the malignant obstruction should be removed through the perineum, if the patient's general condition permits of operation. If it is poor, and metastases are present, permanent suprapubic drainage is more appropriate, with or without subsequent treatment by X-ray or radium. Prior to operation the tumor should receive active radium treatment to lessen the vitality of the malignant cells, because during the operation the malignant mass is usually broken into and blood spaces are opened up which form avenues for the dissemination of the disease. At the time the gland is removed, radium should be left in the prostatic region for at least 500 millicurie-hours. After recovery from the operation, radium and deep X-ray therapy should be used.

L. J. CARTER, M.D.

Excretion Urography G. C. Burr and R. Dovitz Jour Michigan St Med Soc, August, 1931, XXX, 595-600

Attempt is made to evaluate this procedure on the basis of the first 50 cases examined by it in the Department of Urology of the Detroit Receiving Hospital. Excretion urography is still in the process of experimentation but it has evidently come to stay, as it has its value in special cases. Dynamics of the urinary tract can be studied only by this method. It will not supplant retrograde pyelography, which was necessary in 36 out of the 50 cases examined.

The technic was to inject 40 grams of iopax in 100 cc of double distilled water at body temperature. The patient was prepared by being given compound licorice powder at 5 p.m. the day before examination, cleansing enemas in the morning, no breakfast, no fluids 1/50 gr of eserine a half hour before injection, slow injection over a period of 15 minutes, with roentgenograms made at inter-

vals of 15, 30, 60, and 90 minutes following completion of the injection

No alarming reactions were noted, though patients complained of a variety of minor symptoms. In only 18 cases were the results entirely satisfactory. In 13 cases, the upper urinary tract was not visualized, of these, final diagnoses were normal in 5, pyelonephritis (3), kidney tumor (2), perinephritic abscess (1), and renal tuberculosis (2).

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(3) There has not been any stricture formation following the operation in any of the cases observed.

(4) In a clinical and radiographic study of a series of cases, and symptoms or signs of ureteral regurgitation, at any time following the operation were absent.

(5) A number of cases have been found in which the ureteral opening was amply large to admit from seven to nine catheters after the passage of which there was temporary relief. The same cases have shown more permanent, if not definitely permanent, relief following a good wide incision of the opening.

The writer has devised an instrument for performing the operation and illustrations of it are contained in the article.

DAVIS H PARDOLL, M D

Therapeutic Irradiation of the Ovaries A C Siefert Calif and West. Med., October, 1931, XXXV, 290

This paper takes up the therapeutic action

of roentgen rays and of radium when directed against the ovaries of women suffering from benign gynecologic affections, as well as from diseases remote from the sexual organs *per se*, but which are influenced by the ovaries. The opinions here presented are based on personal experience with some sixty patients.

The author then takes up the general considerations, such as the effect of ovarian activity on a healthy genital tract and the body generally, and the sensitivity to radiation of the epithelial constituents of the ovary, which is exceeded only by the lymphatic tissues.

In the use of radium for menostasis not over 800 milligram-hours should be used. For permanent amenorrhea the radium intrauterine dose must be from 1,200 to 1,800 milligram-hours, or from 35 to 40 per cent of a roentgen skin dose must be absorbed by the ovary. The best time for giving the dose is the first half of the intermenstrual period. In younger women the question of post-radiation pregnancy must be considered. This possibility is discussed by the author.

Under the heading of "Special Phases" he discusses the treatment of (1) *Benign uterine hemorrhage*, for which he prefers the roentgen ray. Good results, in his experience, measure up to a 100 per cent standard, provided the proper agent is used and an adequate dosage given. Contra-indications are uncertainty of diagnosis regarding the benign nature of the hemorrhage, the youth of the patient, extremely neurotic individuals, and hypertension.

(2) *Painful menstruation*. Radiation menopause by means of the X-ray is justifiable if the patient has reached her fortieth year. The results in this case are very gratifying. Here the same contra-indications should be considered as given under "Benign hemorrhage."

(3) *Fibromyoma uteri*. Under this heading the question of whether the treatment should be given to the ovary or to the tumor alone is discussed. The author believes that the treatment should be directed to the ovaries. Here he gives as contra-indications the youth of the patient, acute and serious pressure symptoms, degeneration of myomas, pedunculated myomas and infection if acute. Sar-

comatous degeneration and carcinoma of the body of the uterus, in the author's opinion, are not contra-indications, for here pre-operative irradiation would be a distinct benefit. These two conditions, associated with uterine fibromyomas, are, however, rather rare complications.

(4) *Chronic infections of the uterus and adnexa* may be favorably influenced by roentgen-ray therapy. The guiding principle here is the observation that the periodic congestion of the pelvic organs, incident to menstruation, adversely affects the infectious process. Therefore, temporary or permanent menostasis may be accomplished.

(5) *Diseases outside the genital tract*. Carcinoma of the breast therapy in young women is oftentimes helped by stopping the menstrual function. Also, in toxic goiter, the cessation of the menstrual function often causes the metabolic rate to drop sharply. Advanced pulmonary tuberculosis, with slight hemorrhage, is favorably affected by menostasis.

FRANCIS B SHELDON, M.D.

Large Coralliform Kidney Stones and Their Treatment James Thomas Nix Urol and Cutan Rev, October, 1931, XXXV, 631-634

The author discusses two cases, presenting large coralliform kidney stones, and the methods of treatment employed.

The first case record was that of a white female, 55 years of age, who complained of dull pain in the left lumbar and lower dorsal regions. A stone had been removed from the left kidney nineteen years previously. Three years before admission, following an attack of severe pain of 48 hours' duration in the left lumbar region, the patient passed a stone in the urine and felt very much relieved. X-ray examination at this time revealed a large stone in the left kidney. Two weeks before seeking admission the patient again experienced a similar attack of pain. Operation at this time revealed a large coralliform stone, with destruction of the kidney structure. Nephrectomy was accordingly performed and the patient made an uneventful recovery.

The second case was that of a white male,

43 years of age, who, while at work, "felt something drop inside of him." Following this he suffered from rather sharp pains in the lower abdomen, associated with frequent and painful urination. Roentgen examination revealed a bladder calculus and large stones in the kidneys. The phenolsulphonephthalein test at this time was 55 per cent. Urinalysis revealed red blood cells and pus. The bladder stone was removed by suprapubic cystotomy, uneventful recovery resulting. After discharge from the hospital the patient disappeared for three years. He returned because of pains over the right kidney region. X-ray examination showed an increase in size of the calculi previously observed. The phenolsulphonephthalein test at this time was 45 per cent, and gradually decreased to 15 per cent. While this patient's condition has remained practically stationary, the author considers that the real chance for a cure was lost when he failed to return after the cystotomy, as he had been instructed.

The author offers suggestions for consideration in the treatment of large coralliform calculi. Unilateral stones, in cases in which the opposite kidney is good, should be removed by pyelotomy or pyelonephrotomy. Nephrectomy should be reserved for those cases in which the kidney is destroyed. Slight impairment of the opposite kidney is not a contra-indication, but often aids in the restoration of function on the side upon which operation has been done.

Cases of bilateral stag-horn calculi are divided into two groups. The first group includes those patients in poor physical condition because of pathology elsewhere. In this type of case surgical measures should be postponed until the patient's condition improves. The second group includes those cases in which there is some disproportion in the involvement and infection present on the two sides. Surgical intervention is permissible in those cases in which the calculus may be removed without causing much kidney damage. A sufficient interval should always be allowed between operative procedures on the separate kidneys to permit satisfactory repair and restoration of function of the kidney operated upon. The patient should in any case be kept

under a constant observation which should include urinalysis, functional tests, and roentgenograms

J N ANE, M D

GYNECOLOGY AND OBSTETRICS

Roentgenographic Diagnosis of Diseases of the Breast Paul S Seabold *Surg, Gynec and Obst.*, October, 1931, LIII, 461-468

The author describes the normal breast as having continued changes caused by age, adiposity, puberty, menstrual cycle, menopause, and pre-existing pathology

Breasts before puberty are difficult to show radiographically. Breasts before the climacterium vary in architecture by the stage of the menstrual cycle. There is a triangular area in a breast, with the apex towards the nipple. This is shadowed by well-defined lines which are cast by the lactiferous ducts and their fibrous tissue. The first few days after menstruation begins these lines are increased in density, are clear cut, and radiate from the main ducts just behind the nipple. This is called the striated breast triangle. These striations become less distinct as the next period approaches and then are wave-like. Striations at right-angles are developed, which reach a maximum opacity ten days prior to the beginning of menstruation. The breast reaches its greatest compactness at this time. Normal lymph nodes do not cast a shadow.

Little change is noted in a breast before six months of pregnancy. After this time the wave-like appearance is more pronounced and heavier.

After the menopause the triangular striations are crowded together, producing a heavier, more dense triangle. Small oval masses of density caused by small cysts may be seen.

Malignancy of the breast is shown by the disruption of the normal triangle, and in place of striations there is a concentric, whorling appearance, with greatest opacity at the central portion of the mass, the edges of which are quite irregular. In many tumors there is a broad-like radiation from the tumor mass to the nipple. Metastasis is demonstrated as a

faint opacity cast by pectoral or axillary lymph nodes. However, nodes of inflammatory origin may have a like appearance although perhaps a little less dense. Differentiation of abnormal involution from malignancy is difficult, but involution is shown as small oval areas of varying density with well-defined borders.

Benign tumors are localized, do not spread, have well-defined borders, and the linear triangular striations are crowded to one side to make room for the growth. A cyst is less dense than a solid tumor.

There is no bibliography given.

DONALD S CHILDS, M D

Studies of the Time Factor Hermann Wintz *Strahlentherapie*, Oct 24, 1931, XLII, 591-598

The effect of the time factor on the reactions following irradiation was studied in cases which received a sterilizing dose of roentgen rays. If 34 per cent HED effective in the ovaries was applied in one single sitting on the fifth day after the beginning of the menstruation, 95 per cent of these patients did not menstruate any more, and 5 per cent had one more menstruation. After three years all cases still had amenorrhea. The same result was obtained if the same dose was given in one sitting on the eighth day after the beginning of the menstruation.

In another group, 17 per cent HED was given on the fourth and 17 per cent on the eighth day after the beginning of the menstruation. In 21 per cent, one menstruation occurred, in 32 per cent, two menstruations, in 45 per cent, three menstruations, and in 2 per cent, four menstruations after the treatment. Three years later, 78 per cent had still amenorrhea, while in 2 per cent menstruation recurred after the first year, in 15 per cent after the second year, and in 5 per cent after the third year.

Another group received 20 per cent on the fourth and 20 per cent on the eighth day after the beginning of the menstruation. One menstruation occurred in 72 per cent, two menstruations in 24 per cent, and three menstruations in 4 per cent of the cases after the

treatment Amenorrhea was present in all cases three years later

Another group received 25 per cent on the fourth day and 25 per cent H E D on the eighth day after the beginning of the menstruation After the treatment, 86 per cent had no menstruation, 12 per cent had one, and 2 per cent of the patients, two Amenorrhea was still present in all patients three years later

The next group received 28 per cent of the H E D on the fifth day after the beginning of the menstruation One menstruation occurred in 12 per cent, two in 22 per cent, three in 57 per cent, and four in 9 per cent of the patients After three years all patients were menstruating again, the period of amenorrhea having varied from twenty-three to thirty-one months

The last group received 14 per cent H E D on the fourth day and 14 per cent on the eighth day after the beginning of the menstruation In sixteen women the menstruation was not interrupted In one patient the menstruation stopped for three months, beginning six months after the treatment, and in another patient it stopped for four months, beginning five months after the exposure

The figures of this statistical survey are self-explanatory In comparing the susceptibility of the graafian follicles and of the primordial follicles it appears that the cells with more active mitosis recover much easier, while the cells at rest cumulate the applied dose almost completely

ERNST A POHLE, M D , Ph D

Is the Oviduct Open? Lawrence D Smith Jour Iowa St. Med Soc, February, 1931, XXI, 77-80

The answer to a patient's query as to why she cannot become pregnant is not always easy A complete history of wife and husband is necessary, then a thorough physical examination of both If both are found to be normal, the patency of the oviducts is tested by injecting them with iodized oil under fluoroscopic guidance If the tubes are occluded, re-radiate in twenty-four hours The author discusses the therapeutic value of this procedure Contra-indications are given as

carelessness and incompetency, recent uterine bleeding, active infection, recent uterine intervention, uterine pregnancy, malignancies or polyps of the uterus, fever, latent streptococcic salpingitis

W W WATKINS, M D

Traumatic Separation of the Symphysis Pubis Ward L Ekas Am. Jour Obst. and Gynec., May, 1931, XXI, 681-689

According to reported cases, separation of the symphysis pubis occurs infrequently in pregnant women It is estimated as occurring in about one out of 25,000 cases Wishner and Mayer believe it is not as rare as supposed but is often overlooked Separation of the symphysis is often associated with injury to the sacro-iliac articulation The amount of separation of the symphysis which can occur without having an associated sacro-iliac injury has been variously estimated by different authors from 3 millimeters to 7 centimeters

Traumatic separation of the symphysis pubis may be caused by falls, severe strains, forcible separation of the thighs, and internal pressure as in pregnancy Predisposing causes are diseases of the pelvic joints, disproportion, increased mobility during pregnancy, or repeated pregnancies Kehrer describes the formation of cavities or softening in the pubic cartilage or capsule as a predisposing cause Caries, rachitis, osteomalacia, chronic arthritis, trauma during pregnancy, and congenital weakness may predispose toward rupture Sixty-seven per cent of DeLee's cases occurred in forceps deliveries

Prognosis is, as a rule, good Complications, as ruptured bladder, fever and sepsis, embolus, are often serious There is rarely a return when the capsule is torn and subsequent labors are usually easy

JACOB H VASTINE, M D

Eight Years' Experience with Roentgen Diagnosis in Gynecology Pneumoperitoneum and Lipiodol in Pelvic Diagnosis Irving F Stein Am Jour Obst and Gynec., May, 1931, XXI, 671-679

Pneumoperitoneum and lipiodol in pelvic

diagnosis are methods of precision and accuracy. They are safe if ordinary care and skill are employed and if the indications and contra-indications are carefully observed. The contra-indications to lipiodol instillation are bleeding from the uterus, pregnancy, infected interi, and virginity. No accident or complication was encountered by the author in 530 cases of pneumoperitoneum, in 200 of which lipiodol was also employed.

In cases of sterility, the Rubin test should first be employed to determine the patency of the tubes. Introduction of an opaque oil into the uterus, in addition to the Rubin test, is often necessary and demonstrates the point of obstruction. The size and shape of the uterine cavity are of importance. To attempt to diagnose tumors, cysts, and tubal pregnancy by lipiodol instillation is apt to lead to error. For intra-uterine pregnancy it is meddlesome, dangerous, and should be avoided.

Pneumoperitoneum in pelvic diagnosis—A liter of CO₂ is introduced into the peritoneal cavity either by the transuterine or transabdominal route, according to the method described by Peterson in 1921. The uterus, ovaries, fallopian tubes, and bladder are regularly shown and the round ligaments are sometimes seen. The presence or absence of pelvic viscera, when in question, hypoplasia, etc., are demonstrable. Adhesions of the viscera can usually be demonstrated. Intra- and extra-uterine pregnancy (from five to six weeks' duration), lutein, and other cysts of the ovary may be graphically differentiated. Fibroids can usually be easily differentiated.

Combined lipiodol instillation and pneumoperitoneum have been used by the author in over 200 cases and found to be advantageous in establishing the correct diagnosis.

JACOB H VASTINE, M D

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Contributions to the Study of Congenital Malformations of the Heart Antonino

Perez Ara Rev Medicina y Cirugia, Havana, Sept 30, 1931, XXXVI, 657-682

The author gives in this paper a fair outline of congenital malformations of the heart. He presents the case of a goat with an extrathoracic heart, showing pictures and radiographs of the same. In this case, the auricles were inside the thorax, while the myocardium was outside.

N G GONZALEZ, M D

The Importance of Anomalies of the Superior Vena Cava in Man J Beattie Canadian Med Assn Jour, September, 1931, XXV, 281-284

The author refers to the work of Kohler in calling attention to the importance of a careful study of the aortic arch and associated vessels in roentgenograms of the thorax. The superior vena cava is visible in almost every case after the thirty-fifth year, forming a part of the "aortic" or "vascular" shadow in frontal and oblique films. In oblique views the so-called "aortic shadow" has its posterior edge formed by the superior vena cava, or the vena cava projects a little way behind it. It follows, therefore, that an estimate of the diameter of the aorta must take into account the position and size of the superior vena cava. Hence, anomalies of the large venous trunks in the upper thorax take on some practical importance in the radiologic diagnosis of thoracic conditions.

The main venous trunks of the head and arm in the early embryo consist, as in the adult, of an internal jugular vein and a subclavian vein which unite to form a large venous trunk on each side of the body. These veins (the "anterior cardinal" veins of the embryologist) pass vertically downward into the thorax and unite with two corresponding posterior cardinal veins to form two (a right and a left) large venous trunks which enter the primitive heart. Cross-anastomoses between the two anterior cardinal veins are developed but only one of these, which lies at the root of the neck, persists in the adult. Changes take place in the lower part of the left anterior cardinal vein which result in the switching of all the blood from the left side

of the head, neck, and left arm and from the left anterior cardinal vein into the right anterior cardinal by way of the cross-anastomosis between the two veins. Parts of the left anterior cardinal vein persist, but are not normally in continuity with the upper part of the original vessel. The cross-anastomosis between the two primitive cardinal veins becomes the left innominate vein.

From a practical standpoint, anomalies of the superior vena cava can be divided into three classes: (1) Persistence of both primitive anterior cardinal veins and the normal cross-anastomosis between them; (2) persistence of both primitive anterior cardinal veins, but with no cross-anastomosis between them; (3) persistence of the left anterior cardinal vein, with obliteration of the right. Persistence of the right anterior cardinal vein with obliteration of the left is the normal arrangement.

The author has been able to find 175 cases of abnormalities of the superior vena cava, including the three which he himself reports. He concludes that these abnormalities are not incompatible with life, and that Types 1 and 2, as indicated above, are more numerous than Type 3.

The three cases reported by the author illustrate the three types as classified above. They were all obtained postmortem from bodies of adults ranging from 50 to 70 years. They illustrate three stages in the transition from the normal to the completely abnormal condition of a left superior vena cava. The first specimen showed a left superior vena cava alongside a fully developed right vena cava. The second resembled the first, but there was no cross-anastomosis, whereas there was a small one in the first specimen. The third specimen represented the complete abnormality in that the right vena cava was entirely absent, while a left vena cava was fully developed. A cross-anastomosis drained the blood from the right side of the face and neck into the left vena cava.

L J CARTER, M D

Traumatic Aneurysm of the Subclavian Artery as a Late Complication of Fractured

Clavicle E H Cayford and F J Tees
Canadian Med Assn Jour, October, 1931,
XXV, 450-452

This is a case report of a young man, aged 22, who, while playing football, in 1926, broke his clavicle in a forward lunge across the turf. A surgeon set it with apparently good result. His father recalls that at the time there was a great deal of swelling. No X-ray films were taken.

In January, 1931, he complained of pain and tingling in the left arm and hand, the latter also being cold. He had noticed that the pulse of the left wrist had disappeared. Examination showed a large callus at the site of the old fracture, about the middle of the left clavicle, and a palpable mass behind it. The mass was not definitely expansile, though pulsation was easily felt. Auscultation above the clavicle revealed no bruit. X-ray examination showed a rounded tumor, $3\frac{1}{2}$ cm in diameter situated behind the left clavicle and in contact with it. At operation the clavicle was dissected off the mass, and a clearly defined aneurysm of the subclavian artery was found. It was the size of a walnut and wedged in between the clavicle and the first rib. It was calcified laterally and fixed behind and in front to the first rib and the clavicle. The main portion of the mass was removed, a modified Matas endo-aneurysmorrhaphy being done. The repair was supported with the sheath of the subclavian muscle.

About four weeks later a mass appeared suddenly at the site of operation, accompanied by excruciating pain about the neck and arm. At operation a large laminated clot was found lying between the tissue layers. On manipulation the clot gave way and the gush of arterial blood was stopped by corking the artery with the finger. Ligatures *en masse* were passed until all bleeding ceased, the vein as well as the artery being occluded in the process. There was some edema of the extremity during convalescence and considerable pain in the index finger and thumb, but capillary circulation was maintained and the arm and hand remained warm. When last seen, about four months later, there was no evidence of sensory or motor disturbance and the patient enjoyed the full use of the arm.

The authors conclude that it would have been better to have adopted a less conservative attitude at the first operation, and at that time to have tied off the artery and accompanying vein

L J CARTER, M D

A Case of Enormous Antemortem Dilatation of the Heart Antonino Nicotra Archivio di Radiologia, May-June, 1931, VII, 473-479

A boy, 22 years of age, had an X-ray examination made of his thorax. The radiograph (illustrated) showed a median shadow occupying three-fourths of the right hemithorax. Without autopsy control, the author thinks it a case of enormous dilatation of the right auricle and ventricle, since all other possibilities were eliminated in making the diagnosis

E T LEDDY, M D

A Case of Multiple Aneurysms of the Aorta and Great Vessels H F Mowat. Canadian Med Assn Jour, October, 1931, XXV, 453, 454

Multiple aneurysms are usually more frequent in the larger arterial trunks, especially the thoracic aorta. Klotz collected 695 cases of thoracic aneurysm, and found that 70, or 9.8 per cent, were multiple in type. The series included saccular, dissecting, and fusiform varieties. Colt made a comprehensive survey of aneurysms in the British Isles, and found 575 dependable records of thoracic aneurysm. Multiple saccular dilatations were found in 59, or 9.1 per cent. Boinet reported 31 cases of multiplicity in 340 cases of thoracic aneurysms, or 11 per cent.

The author reviews 26 cases of aneurysm of the thoracic aorta found in 1,862 autopsies performed in the Department of Pathology of the University of Toronto since 1925. Of these, two cases were multiple. Both were due to syphilitic invasion of the arterial wall. Campbell Howard points out that this is always the cause of the multiple saccular type of thoracic aneurysms. This point is borne out by Graves, who reports 45 thoracic aneurysms

occurring in 1,595 postmortem examinations. Of these, six were multiple, and all six were due to syphilis.

The case reported by the author was that of a white male 55 years old, by occupation an iron worker. The family history was negative. No history of abortions or premature deliveries by his wife was given. Syphilis was denied. There was no history of alcoholism or the use of tobacco. His complaints were of hoarseness and a non-productive cough of five months' duration. There had been a loss of fifteen pounds in weight. Slight dyspnea and mild attacks of dizziness were complained of on exertion. There was complete paralysis of the right vocal cord.

X-ray examination of the chest revealed an aneurysm of the ascending aorta and the innominate artery. The blood Wassermann test was strongly positive. Following intensive anti-syphilitic treatment the patient returned to work after three months. Subsequently, he died suddenly on the street.

The postmortem findings were those of multiple aneurysms of the thoracic aorta, beginning at the aortic cusps and the sinuses of Valsalva, the innominate artery, the subclavian artery on the left side, and the transverse aorta. The right recurrent laryngeal nerve was adherent to the aneurysm of the arch, and was atrophied.

L J CARTER, M D

Heart Conditions Simulating Acute Abdominal Symptoms Gerald R Burns Canadian Med Assn Jour, October, 1931, XXV, 424-428

This is a presentation and analysis of a number of cases, with the idea of showing that, without the X-ray or electrocardiograph, a differential diagnosis can be made and the important decision as to medical or surgical treatment indicated. The author states that within the last fifteen months he has seen four cases of coronary artery thrombosis which were sent into the hospital with the diagnosis of acute abdominal emergency.

Three illustrative case histories are cited. The first, a farmer, aged 46, was admitted,

complaining of severe abdominal pain, centered in the epigastrum. He was in a condition of shock. The diagnosis was ruptured gastric ulcer. He had a history of acute rheumatic fever seven years before. During the past two years he had experienced increasing shortness of breath, and had had several attacks of moderately severe pain in the stomach, diagnosed as acute indigestion. The admission diagnosis was not confirmed, but a diagnosis of coronary artery thrombosis was made. This was confirmed later by the electrocardiograph.

The second, a farmer, aged 45, was admitted complaining of severe pain below the sternum. The diagnosis was acute abdomen. After examination, a diagnosis was made of coronary artery thrombosis, and the patient was saved an unnecessary operation called for by the admission diagnosis.

The third, a farmer, aged 46, was admitted, with a history of two years' duration of attacks of abdominal pain, centering in the epigastrum and relieved by vomiting. A diagnosis of angina pectoris was made.

In all of these cases, in spite of the apparent reference to the abdomen, there were definite heart findings, which should have indicated the diagnosis. In all, the heart was enlarged to the left, there was some cyanosis, usually a precordial rub or friction sound, no definite localized area of acute tenderness in the abdomen, and the pain was made worse by exertion.

Thrombosis of the coronary artery is by far the worst offender in the class of cardiac conditions which may offer some difficulty in differentiation from acute abdominal conditions. There is an acute attack of angina not relieved by amyl nitrite but only by repeated large doses of morphine. When the pain, instead of radiating down the arm, radiates toward the abdomen, as in the cases cited, the diagnosis offers some difficulty.

In the examination of the patient, one of the most important points is that the history of the illness should be unbiased and accurate. Special attention should be given to the family history, as regards death from high blood pressure, apoplexy, angina pectoris, and so-

called acute indigestion, or any sickness on the patient's part that might lead up to these conditions.

The characteristic things that point to coronary thrombosis are (1) The tinge of cyanosis about the tips of the nose and fingers, the lobes of the ear, and lips, (2) the stillness of the patient, as contrasted with the restlessness of the abdominal patient, (3) the drop of the blood pressure from a previously high level, (4) the enlarged heart, which is rapid, (5) the adventitious heart sounds which are usually present.

The fever, upper abdominal tenderness, leukocytosis, and pain in the epigastrum, are more or less features common to coronary thrombosis and acute abdominal conditions, and offer no special aid in the differential diagnosis. Angina pectoris is differentiated by the fact that the pain produced by it is relieved by amyl nitrite, while the pain of coronary artery thrombosis is relieved only by large doses of morphine.

The electrocardiograph gives a characteristic tracing.

L J CARTER MD

CHEMICAL ABSTRACTS

The Magnetic Spectrum of α -rays from the Active Deposit of Actinon. Mme P Curie and S Rosenblum. Compt rend., 1931, CXIII, 33-35.

The source of Act has previously been described. The oxides obtained from the oxalates were dissolved in HNO_3 , and La was precipitated with NH_4 . Part of the Act X was then precipitated with $(NH_4)_2CO_3$, and later converted to the fluoride. The remainder was carried down with $Fe(OH)_3$. Both products were used to obtain an active deposit by placing them in a brass tray having an insulated cover on which was attached a bit of Au (2×0.01 cm.). An electromotive force of 1,000 V was set up and the active deposit collected on the Au cathode, with about 30 per cent yield in eight days. By means of a large electromagnet the following ratios were measured: $V_{\alpha}/V_{\alpha} = 0.973$ and $V_{\alpha'}/V_{\alpha} =$

where V_α is the velocity of the more intense of the two strong rays, α and α_1 , due to Act C, and V_{α_2} is the velocity of the weak ray due to Act C' The difference $\alpha - \alpha_1$ corresponds to 352 KV electrons, a group of γ -rays of this energy is attributed to Act C"

CHEMICAL ABSTRACTS

The Distinction of Analcime from Leucite in Rocks by X-ray Methods F A Bannister Mineralog Mag, 1931, XXII, 469-476

Powder photographs have satisfactorily confirmed the identity of analcime phenocrysts in blairmorites from Lupata Gorge Laue photographs using monochromatic radiation indicated that the phenocrysts were made up of smaller individuals in sub-parallel position The X-ray data are tabulated

CHEMICAL ABSTRACTS

The Relation between Long-range Alpha Particles and Gamma Rays Mme P Curie Compt rend, 1930, CXCI, 1055-1058

There seems to be some plausibility in the theoretical view that α -particles of average range come from the normal nuclear level while those of long range come from an upper nuclear level For Th C' and Ra C, the agreement of experiment with this view is not good, but experimental work is still incomplete

CHEMICAL ABSTRACTS

Fine Structure in the X-ray K-series Absorption Edges of Elements of the Middle Range of Atomic Number Heinz-Theodor Meyer Wiss Veroffentlch Siemens-Konzern, 1931, X, No 2, pp 95-98

Photometric curves of photographic spectra of the X-ray critical absorption limits of compounds of Rb, Sr, Y, Zr, Cb, and Mo are reproduced Fine structure is indicated in some cases but it is very faint It is stated that an examination of higher compounds of Sc and As shows a well-developed fine structure similar to that previously found for Br compounds The results are in agreement with the general rule that fine structure is found

principally in the higher states of combination of elements, which have multiple valences

CHEMICAL ABSTRACTS

The Radio-activity of Air, Oxygen, and Carbon Dioxide Gust A Aartovaara Tek Foren i Finland Forhandl, 1931, LI, 211-215

Finely divided U and Th minerals were suspended in colloidal solutions, and the radioactive emanation carried off by air which passed through them was measured over a period of three years The amount fell to about 3 per cent of the original during that period This aging process became much more pronounced when the O was supplied under pressure It is therefore concluded that the use of radio-active O for inhalation can be effective only for short periods Cylinders of CO₂ also showed a marked radio-activity, presumably because the Rn in the air is liquefied with CO₂ An investigation of carbonated drinks showed the activity varied from 20 to 100,000 Mach units It is suggested that this may account for the success which has been attained with CO₂ snow in curing leprosy and in transportation of foods

CHEMICAL ABSTRACTS

Roentgenographic Investigation of the Orthotitanates Sven Holgersson and Adolf Herrlin Ztschr anorg allgem Chem, 1931, CXCVIII, 69-78

Mg, Co, Zn, and Mn orthotitanates were prepared synthetically by fusion of the metallic oxides with TiO₂ at 1000° All of the orthotitanates belong to the spinel type, with dimensions as follows Mg₂TiO₄, $a = 8.44$ Å U, Co₂TiO₄, $a = 8.43$ Å U, Zn₂TiO₄, $a = 8.44$ Å U, Mn₂TiO₄, $a = 8.67$ Angstrom units

CHEMICAL ABSTRACTS

The Radio-activity of Potassium and Rubidium Measured with a Geiger Counter W Muhlhoff Ann Physik, 1930, VII, 205-224

The absorption coefficient of the γ -radiation of K in Pb was, $\mu_{Pb} = 0.59$ cm⁻¹, with γ -ray

measurements of Ra C and Th C as standards Insufficient Rb precluded measuring its γ -ray activity Comparison with a standard 0.03 mg Ra sample gave the ratio of the intensity of the γ -radiation of Ra C (in equilibrium with Ra) to that of K as 3×10^{10} 1 β -ray activities gave intensities K Rb U = 1 16 500, if U X₁ is considered as the only β -radiator in U

CHEMICAL ABSTRACTS

A Precision X-ray Spectrometer and the Wave Length of Mo K α_1 , Arthur H Compton Rev Sci Instruments, 1931, II, 365-376

The instrument has two crystals in series the first is mounted on an arm projecting from the frame, the second is placed on the central table whose position is read from a precision circle For the K α_1 line of Mo the reflection maxima from calcite (cor to 18°) occur at $\theta_1 = 6^\circ 42' 35.5''$ and $\theta_4 = 27^\circ 51' 33.0'' \pm 0.25''$ in each case If the apparent grating space for the first order is 3.02904 Å U, then $\lambda = 707.830 \pm 0.002$ Å U Comparison of θ_1 with θ_4 gives n for calcite, $1 - \mu = (2.10 \pm 0.15) \times 10^{-6}$

CHEMICAL ABSTRACTS

The X-ray Classification of Epidermal Proteins Thora C Marwick Jour Textile Sci, 1931, IV, 31-33

X-ray photographs, four of which are given, demonstrate the existence of at least three different forms of keratin Natural silk is probably in an extended state, since its X-ray photograph resembles that of hair or wool stretched artificially

CHEMICAL ABSTRACTS

Industrial and Chemical Research with X-rays of High Intensity and with Soft X-rays George L Clark and Kenneth E Corrigan Ind Eng Chem, 1931, XXIII, 815-820

A high-power X-ray tube is described with which diffraction photographs have been obtained in one-twentieth of a second and which permits visual observation of diffraction patterns on a fluorescent screen The authors

also describe a tube combined with an evacuated diffraction camera in which X-rays of long wave length (about 10 Å U, Mg K) are utilized Preliminary work on rubber and cellulose reveals some long spacings of the order of 200 Angstrom units Important applications for these developments are outlined

CHEMICAL ABSTRACTS

Nature of Eutectoid Transformation of Aluminum Bronze III—X-ray Analysis, IV—X-ray Analysis at High Temperature Ichiji Obinata Mem Ryojun Coll Eng, No 4B, 1931, III, 285-294, 295-298

Alloys were prepared by melting in a graphite crucible under salt coverings and then sucked up into magnesia capillary tubings of about 1- to 1.5-mm bore, to make rod-shaped specimens After having been heat-treated, they were subjected to X-ray analysis X-ray analysis of a saturated solid solution of the α - and δ -phases, the latter containing 16 per cent Al, has confirmed that it has a face-centered cubic lattice and a cubic lattice containing 52 atoms in the elementary cell The photogram obtained from the quenched alloy containing 16 per cent Al showed no differences in the distribution of the spectral lines, as compared with those obtained from the annealed one The quenched alloy containing 12.5 per cent Al consists essentially of the β' -phase mixed with a small quantity of the β -phase, in which the former was found to have a hexagonal-lattice construction $A = 11.13$ Å U, $C = 6.342$ Å U, while the latter had a body-centered cubic super-lattice, having a parameter of 5.835 Angstrom units The decomposition of the β -phase into the β' is retarded on quenching, either when quenched in toluene cooled to a very low temperature, or when Mn is added X-ray analyses of the tempered alloys containing 12.5 per cent Al have confirmed that the change $\beta \rightarrow \beta'$ takes place between 400° and 450°, and that the change $\beta \rightarrow \alpha + \delta$ is nearly completed at 500° By using a high-temperature camera, a powder photogram of a fine rod of Al bronze containing 87.62 per cent Cu was taken at about 650° This confirmed that at 650° this alloy consists solely of the β -phase, which is a

body-centered cubic super-lattice, having a parameter of 5.887 Ångstrom units

CHEMICAL ABSTRACTS

A Study of Tendons, Bones, and Other Forms of Connective Tissue by Means of X-ray Diffraction Patterns Janet H Clark Am Jour Physiol, 1931, XCIVIII, 328-337

Inorganic crystals of apatite are present in bone, oriented so as to give fiber structure in longitudinal section Unoriented crystals are present, which are thought to be organic crystals of collagen or ossein Dentine contains unoriented inorganic crystals of apatite and also, probably, unoriented crystals of collagen Tooth enamel contains only inorganic crystals of apatite, oriented with respect to the prisms so as to give a fiber pattern

CHEMICAL ABSTRACTS

The Ultra-violet Light Absorption of Ethyl Alcohol Purified by Different Methods Philip A Leighton, R W Crary, and L T Schipp Jour Am Chem. Soc., 1931, LIII, 3017-3019

Measurements of the absorption coefficients of EtOH, purified in various ways, in the region of 2,500-3,000 Å U show it to be a very delicate method for determining impurities The measurements indicate that the standard practice of drying over CaO should be carried out in an O-free atmosphere The highest purity was obtained by the use of Al amalgam

CHEMICAL ABSTRACTS

Theory of X-ray Absorption J Fischer Ann Physik, 1931, VIII, 821-850

Absorption coefficients for X-rays and angular distribution of photo-electrons from K and L shells are calculated relativistic effects (except "Doppler") being disregarded Within these limits the calculations of Sommerfeld and Schur are checked, and the results agree with experiments

CHEMICAL ABSTRACTS

PHYSICAL ABSTRACTS

Wave Length Standards in the Extreme Ultra-violet Aluminum Spectrum Jonas Soderqvist and Bengt Edlén Ztschr Physik, 1931, LXIX, 356-360

A list is presented of about 50 accurately measured wave length standards in the Al spectrum, extending from 312 to 68 Å U in the extreme ultra-violet The wave lengths were derived by comparison of the higher orders of the lines with the Fe standards between 4,500 and 2,300 Å U The Al lines were emitted by a high potential spark discharge in vacuum and belong to Al IV and higher stages of spark spectra

CHEMICAL ABSTRACTS

Temperature Effect in Diffuse Scattering of X-rays from Rock Salt W D Claus Phys Rev, 1930, XXXV, 1427

Experiments conducted to test the effect of temperature on the scattering of X-rays indicate in the range from 295° to 135°, a much smaller decrease than that expected from the Debye equation

CHEMICAL ABSTRACTS

Diffuse Scattering of X-rays from Sylvine at Low Temperature G E M Jauncey and G G Harvey Phys Rev, Dec 1, 1931, XXXVIII, 1925-1931.

By use of a modification of the photographic method described by Claus, the authors have compared the intensities of X-rays of wave length 0.43 Å, diffusely scattered from sylvine at angles in the range 25° to 90° at a temperature of 90° K, with the intensities at these same angles at a temperature of 300° K The authors have shown that the intensity of the diffusely scattered rays should be given by $S = S' - F^2/Z$, where S' is independent of the temperature and F is the atomic structure factor containing the effect of thermal agitation With James and Brindley's F values at 90° K and 300° K, theoretical values of S for 90° K have been calculated The experimental S values at 90° K are lower than the theoret-

tical S values This result is in accord with that found by Claus for rock salt Plotting $\log (S' - S_1)/(S' - S_2)$, where the subscripts refer to the two temperatures, against $(\sin^2 \phi/2)/\lambda^2$, a straight line is obtained whose slope agrees with that required by the Waller and not the Debye formula for the temperature effect It is impossible by means of this experiment to show whether or not there is zero point energy In order to do this, an assumption concerning the electron distribution in the atom must be made

THE AUTHOR

Higher Order Effects in the Diffraction of X-rays by Liquids W C Pierce Phys Rev, Oct 15, 1931, XXXVIII, 1413-1419

The X-ray diffractions of liquid carbon tetrachloride, chloroform, benzene, solutions of carbon tetrachloride in benzene, o-dichlorbenzene and m-dichlorbenzene have been determined for $MoK\alpha$ rays by the ionization spectrometer All give a main peak characteristic of liquids and, in addition, the halogen compounds give other maxima in the intensity-angle curve at large angles This effect is the same for carbon tetrachloride, pure or in solution, and is consequently thought to be due to internal interference caused by scattering from the chlorine atoms Debye's relation for the scattering of single atoms cannot be applied because the positions of the peaks obtained from solutions are masked by the molecular scattering of the solvent

THE AUTHOR

The Regular Reflection of X-rays from Quartz Crystals Oscillating Piezoelectrically Gerald W Fox and James M Cork Phys Rev, Oct. 15, 1931, XXXVIII, 1420-1423

Laue patterns from quartz crystals oscillating piezoelectrically have been observed to be more intense than similar patterns from non-oscillating crystals In this investigation, regular Bragg reflections from the face of crystals oscillating and non-oscillating have been observed in order to notice any variation in intensity or line width No effect of this kind

has been observed These results are interpreted as negating the existence of Zwicky blocks, rocking slightly by the piezoelectric oscillations, as proposed by Langer An explanation of the observed effect with Laue spots based upon the extinction effect in perfect crystals is proposed

THE AUTHOR

Precision Measurements of Air Ionization by Roentgen Rays of Definite Hardness and Homogeneity in Barrel Chambers of Smallest and Largest Size Hans Kustner Strahlentherapie, Oct 3, 1931, XLII, 337-343

The author determined the error in absolute measurements of the r due to an unsuitable diameter of the ionization chamber Curves are presented giving quantitative data on the influence on the end-result of chamber volume, homogeneity of radiation, and scattering within the chamber The author emphasizes the many precautions necessary in carrying out precision measurements and suggests that his data, rather than inadequate determinations be used for corrections

ERNST A POHLE, M D, Ph D

Lateral Space Distribution of X-ray Photo-electrons Paul Kirkpatrick Phys Rev, Dec 1, 1931, XXXVIII, 1938-1942

The lateral distribution in space of the directions of emission of photo-electrons ejected from argon atoms by partially polarized X-rays having the mean wave length 0.53 Å was determined by examination of photographs of 2,008 condensation tracks produced in a C T R Wilson expansion apparatus Discarding by a definite analytical procedure the isotropically distributed emissions, which are ascribed to unpolarized radiation, the distribution of the remaining 752 tracks is found to be in excellent agreement with the indications of quantum mechanics that (for K electrons) the probability of emission is proportional to the square of the cosine of the angle between the electric vector of the absorbed radiation and the projection of the direction of emission upon a plane normal to the direction of incidence

THE AUTHOR

The Reasons for the Broadening of X-ray Diffraction Lines with Powder and Rotating-crystal Photograms U Dehlinger Ztschr Metallkunde, 1931, XXIII, 147-149

The broadening of diffracted X-ray lines may be ascribed to three fundamental crystallographic conditions gradual variations within the lattice, abnormally small grains, abrupt variations within lattice Gradual variations may be of two types variations in lattice parameter originating in concentration differences in solid solutions, and those originating in elastic distortion The variations in lattice constant must be approximately constant within a range of at least 0.5μ . A concentration variation of 3 per cent Zn in a Cu-Zn alloy will cause a broadening equal to the distance between the lines of the $K\alpha$ doublet from Cu Elastic distortion, caused by strains, must likewise be approximately constant within a range of 0.5μ . Failure to fill this condition results only in a displacement and of a broadening of line A grain size less of pressure and temperature of the I_2 vapor gave the effective cross-section in collisions of the excited Na atoms with I_2 molecules or atoms In the first case a corresponding decrease in effective cross-section was found for increase in velocity of the Na atoms For collisions with I_2 atoms the effective cross-section is about ten times smaller than the maximum value for collisions with molecules and shows no decided dependence on velocity

CHEMICAL ABSTRACTS

Absorption of Soft X-rays in Gases R G Spencer Phys Rev, Dec 1, 1931, XXXVIII, 1932-1936

A crystal spectrograph for measuring absorption coefficients of soft X-rays in gases has been constructed, and with it absorption coefficients of air, argon, and oxygen have been measured for spectral lines of wave lengths 1537, 2284, 4145, and 6973 Ångströms Absorption coefficients in the regions immediately adjacent to the K absorption limit of argon have been measured with general radiation No departure from the ordinary absorption law greater than experimental error

was found in these regions The magnitude of the K absorption discontinuity of argon was measured by a method which is not dependent upon the extrapolation of curves to the absorption limit, and also by a method which is independent of the absolute magnitude of the absorption coefficients on either side of the absorption limit

THE AUTHOR.

The Production of Intense Monochromatic X-rays with Technical Tubes without Spectral Apparatus Hans Kustner Ztschr Physik, 1931, LXX, 324-347

By means of a differential method, using selective filtering, very intense and highly monochromatized radiation was obtained The $K\alpha, \alpha'$ doublet was obtained practically pure

CHEMICAL ABSTRACTS

The Effect of General Radiation in the Diffraction of X-rays by Liquids W C Pierce Phys Rev, Oct 15, 1931, XXXVIII, 1409-1412

Previous work has shown that the amount of general radiation transmitted by a single filter may cause peaks in the diffraction pattern of liquids Balanced strontium and zirconium filters are used to study the magnitude of this effect in X-rays from a molybdenum tube operating at 35 KV Zirconium alone does not give sufficient filtration under these conditions, but by use of the two filters the effects of the general and characteristic radiation may be completely separated

THE AUTHOR.

The Scattering of X-rays from Paraffin, Aluminum, Copper, and Lead Allen W Coven Phys Rev, Oct 15, 1931, XXXVIII, 1424-1431

The radiation from a tungsten-target X-ray tube operated at 80 KV was filtered through 0.244 cm of aluminum, and the intensities of the scattered radiations from paraffin, aluminum, copper, and lead were observed by the ionization method The scattered intensities at angles in the range of 30° to 120° with the forward direction of the primary beam were

compared with the scattered intensities at 90 degrees. Values of the intensity at 90° for paraffin were compared with the intensity at 90° for the other materials. The scattering from paraffin and aluminum was at an effective wave length of 0.32 Å, from copper 0.26 Å, and from lead 0.27 Å. The Dirac value of the scattering from paraffin at 90° was used as the basis for calculating the absolute values of the scattering per gram and the scattering per electron.

THE AUTHOR.

A Classical Effect of the Scattering of Radiation Otto Halpern Ztschr Physik, 1931, LXVII, 523-530

It is pointed out that the light scattered by an isolated oscillator consists not only of the coherent radiation due to the forced vibrations, but also of those frequencies which correspond to the proper frequencies of the oscillator. This is illustrated by calculating the scattered radiation when a wave of sharply cut head and tail acts on the oscillator. These considerations are also interpreted quantum-mechanically with the use of relations of Weisskopf and Wigner for the shape of a spectral line. To observe this effect, experimentally, light near the proper frequency ought to be used, or X-rays of suitable wave length.

CHEMICAL ABSTRACTS

Origin of the Gamma Rays Lord Rutherford and C D Ellis Proc Roy Soc London, C, 1931, CXXXII, 667-688

A lengthy discussion is given on radiation

and disintegration transitions from excited nuclear states, and radiationless transitions and general complexity of β-ray spectrum. All existing data on energies of γ-rays are listed and classified with an attempt to deduce a "level" system. It is found that there is, seemingly, a possible classification, inspection shows that the difference in energies between a number of the lines is approximately 0.4×10^{-5} electron-v or a multiple of this number. It is attempted to see whether the energies of the γ-rays can be formulated by an expression of the type $E = pE_1 - qE_2$, where p and q are integers and E_2 is a constant which is small compared to E_1 . Curves showing the success of the analysis are given.

CHEMICAL ABSTRACTS

A Small Contribution to the Chapter of Physiologic Effects of Atmospheric Electricity C Dorno Strahlentherapie, Sept. 12, 1931, XLII, 87-95

The author has written this brief article in honor of the fiftieth birthday of Professor Dessauer (Frankfort on Main). He states that the atmospheric electricity undoubtedly causes physiologic effects. The case of a major is related who, because of war injuries, suffered from tinnitus. He kept a diary for a period of several years showing the type of noise experienced during the hours of the day. Comparison of the curves plotted from these data with the changes in the atmospheric electricity showed very definite relations. Dessauer's experiments with air charged unipolar will in all probability throw further light on this interesting phenomenon.

ERNST A POHLE, M D, Ph D

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RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA

VOL XVIII

MARCH, 1932

No 3

PART II

IMPORTANT ANATOMICAL DATA OF THE DIGESTIVE TRACT¹

By THE COLE COLLABORATORS

KNOWLEDGE of certain anatomical facts concerning the various parts of the digestive tract is very essential, both to an understanding of the findings observed, and for an intelligent and accurate application of the roentgenologic method of examination in eliciting the information that is desired. In the following section it is not our intention to review completely the anatomy of the digestive tract, but, rather, to point out the essential anatomical facts, some of which are common knowledge, but others of which are seldom, if ever, referred to in the standard or even in the special textbooks of anatomy.

Anatomy of the Esophagus—The esophagus is a musculo-muco-membranous canal which extends from the pharynx to the stomach. The anatomical relations of the esophagus as observed roentgenologically are illustrated in Figure 20. It commences superiorly at the upper, posterior border of the cricoid cartilage, and terminates inferiorly about from 3 to 5 cm below the diaphragm at the cardiac orifice of the stomach. The esophagus descends along the front of the vertebral column, and, except in the cervical region and abdomen, lies in the posterior mediastinum. In the cervical region the esophagus lies between the vertebral column and the larynx and trachea. In the thorax it lies in close relation anteriorly from above downward with the trachea, the left main bronchus, and the pericardium, i.e., the posterior surface of the heart. The anterior part of the arch of the aorta is in front of the esophagus and is separated from it by the trachea, but in the upper mediastinum the terminal (posterior) part of the arch of the aorta is in contact with the left side of the esophagus.

The general direction of the esophagus is vertical, but it presents several lateral curves and also slight anteroposterior curves corresponding to the curvature of the cervical and thoracic portions of the vertebral column. The lateral curves are more marked when the individual is in the recumbent posture, due to the release of the tension on the esophagus which is present when one is erect. As regards the lateral curves the esophagus at its commencement

¹Presented at the Third International Congress of Radiology, Paris, July, 1931, by Lewis Gregory Cole M.D.

is in the median line, but inclines to the left in the lower cervical region so that it lies partially behind the left lobe of the thyroid. In the upper thorax the esophagus gradually passes to the mid-line again, and in the lower thorax, about 5 cm above the diaphragm, it inclines to the left and forward away from the vertebral column. Below the diaphragm it still inclines forward and to the left to join the stomach.

The caliber of the lumen of the esophagus varies with the presence or absence of swallowed substances, and varies considerably with the size of the bolus passing through it. The caliber is also anatomically somewhat irregular. Many points of narrowing have been described, but those of chief importance are at the introitus, at the level of the aortic arch, at the crossing of the left bronchus, at the level of passage through the diaphragm, and at its termination—the cardiac orifice of the stomach.

The close relation of the esophagus to the posterior part of the arch of the aorta in the upper mediastinum, and the posterior surface of the heart below the level of the bifurcation of the trachea, is of considerable importance. Changes in size and shape of these parts of the heart and aorta are directly reflected in displacement of and pressure on the esophagus. Therefore, roentgenographic examination of the esophagus when filled with an opaque substance, maps out accurately the contour of these parts of the heart and aorta.

The abdominal portion of the esophagus is of smaller caliber than the rest of the esophagus. This portion may be somewhat conical in shape, with its base toward the stomach, particularly when a small bolus is temporarily lodged in the esophagus between the level of the diaphragm and the stomach. Roentgenographically and anatomically (Moser) the esophagus at the hiatus esophageus of the diaphragm often shows the impression of the left crux of the diaphragm. The so-called cardiospasms involving the esophagus are not limited to the junction of the stomach and esophagus, but extend throughout the lower end of the esophagus from the cardiac orifice to a point about one-half inch above the left crux of the diaphragm.

The esophagus has five coats—an internal or mucous coat, a muscularis mucosæ, a submucous coat, a muscular coat, and an external or fibrous coat (see Fig 21). The mucous coat is covered throughout with a thick layer of stratified pavement epithelium. Between the mucosa and the submucosa is the muscularis mucosæ, a layer of longitudinally arranged smooth muscle tissue. The submucosa is a loose areolar connective tissue which connects loosely the mucous and muscular coats. The esophageal glands, which lie in the submucosa, are small compound racemose glands of the mucous type. The muscle coat (muscularis propria) is composed of two layers of smooth muscle of considerable thickness. The muscle fibers of the inner layer are arranged circularly, and the fibers of the outer layer are arranged longitudinally.

When empty, the esophagus is contracted and its anterior and posterior walls come in contact. The inelastic mucous membrane folds longitudinally (Fig 33), so that on transverse section the lumen of the contracted esophagus is stellate in form (flattened anteroposteriorly).

Roentgenographic examinations have shown that the esophagus normally

does not contain air. However, we not infrequently observe, when a bolus of barium paste is swallowed, that a cylindrical bubble of air is forced down ahead of the bolus. This bubble of air may pass into the stomach, or, after reaching the lower end of the esophagus, the air bubble may pass up along one side of the barium (Figs 22 and 23). It is important not to consider these air bubbles as filling defects in the wall of the esophagus. The shift in position of the air bubble is usually sufficient protection against an erroneous interpretation.

Partial herniation of the stomach through the hiatus esophageus is a not infrequent anomaly, and a persistent air bubble in the digestive tract just above the left crux of the diaphragm is usually due to this condition.

Anatomy of the Stomach.—For the sake of simplicity of description, the stomach may be considered as divided into four chambers, the fornix, corpus, antrum, and cap, by three partitions, the pyloric valve, sulcus angularis, and corporic shelf. This is somewhat similar to Forssell's division of the stomach. Each of these regions will be considered, in the order named.

Fornix.—The fornix is indicated in the schematic drawings (Figs 26 and 27) by horizontal parallel lines. For the purpose of roentgenologic exploration, it may be filled with air or barium. When filled to complete distention, it conforms with the dome of the diaphragm, an excellent reason for terming this region the "dome" of the stomach. This conveys its shape to every one wherever the English language is spoken, whereas most of us must turn to the dictionary for the origin, or meaning, of the term "fornix".

Corpus.—The corpus, or body, of the stomach is indicated by vertical parallel lines in Figures 26 and 27. It is the largest and most distensible chamber of the stomach. With the patient in the erect posture it forms a vertical column, the right side of which extends from the esophagus to the sulcus angularis, and the left side of which extends to the most dependent portion of the greater curvature. When completely filled, the corpus is free of rugae; when it is empty, or partly filled, the mucosa is thrown into folds or rugae (Figs 33, 34, and 35).

Antrum.—The antrum is indicated in Figures 26 and 27 by oblique parallel lines, and is that portion of the stomach between the sulcus angularis and the pyloric valve. When distended it is egg-shaped, with the small end of the egg lying toward the pyloric valve, and it is free of rugae, so that the mucosal surface, as observed roentgenographically, is smooth. During a short period of each gastric cycle the distal end of the antrum is contracted by the fan-shaped pyloric muscle into a pyloric canal, which is indicated by cross-hatching in Figure 27. During this period the mucosa of this region is thrown into characteristic folds.

Cap.—The cap, which we shall subsequently consider as a separate organ, may be included here as a fourth chamber of the stomach. (It is indicated by dots in schematic Figures 26 and 27.) It is bounded proximally by the pyloric valve, and distally by the first of the valvulae conniventes that are so characteristic of all portions of the small intestine. When the cap is distended it corresponds in size and shape to the pyloric antrum and sets upon the latter.

like a brimless cap, or *beret*. If the partition between the antrum and cap is obscured by a pencil, the significance of the cap, as relating to the stomach rather than to the small intestine, becomes apparent. When the cap is distended it is singularly free of rugæ, when contracted, its mucosa has a characteristic appearance. The mucosal pattern of the cap is somewhat similar to that of the stomach, but it differs radically from that of the duodenum and all other portions of the small intestine.

Pyloric Valve.—On roentgenologic exploration, the lumen of the cap is found to be separated from the lumen of the antrum by a clear-cut, well defined space about 3/16ths of an inch (0.5 cm.) in length (longitudinal axis of the gut). The length of this space may vary slightly with different cases and with different phases of the cycle of gastric peristalsis, but it is one of the most definite findings in the entire gastro-intestinal tract, and, roentgenologically, is the monumental landmark from which to measure in either direction. It serves as one of the best illustrations for the demonstration of our second fundamental finding, namely, the muco-membranous fold viewed on edge (Figs. 31, 37, and 52).

Sulcus Angularis.—The antrum is separated from the corpus by a less definite partition located at the point of the *incisura angularis*. This partition, although varying considerably in length, is markedly constant in its thickness, as illustrated by Figures 32 and 51. This partition also serves to illustrate the second fundamental finding. The base of the *sulcus angularis* is opposite the receding angle or *incisura angularis*, which may be observed on the outside of the stomach.

Corporic Shelf.—The corpus is separated from the fornix by a less definite partition, the corporic shelf, that occurs about on a level with the esophageal orifice (Figs. 28 and 29). This corporic shelf is not a constant roentgenologic finding.

Variation in Shape of the Stomach during a Single Cycle of the Complex Gastric Motor Phenomenon.—The stomach goes through a series of shapes and comes back to its original shape about once in twenty seconds. This recurrent series of events is known as a "gastric cycle," ten stages of which are shown in Figure 30. The gastric cycle, like the cardiac cycle, has a systolic and diastolic phase. Likewise, similar to the asynchronous systole and diastole of the auricles and ventricles of the heart, there is an asynchronous systole and diastole of two divisions of the stomach, the first of these functional divisions being the corpus and the proximal part of the antrum, and the second being the pyloric canal. During systole of the first or superior division, termed "systole of the stomach," peristaltic waves of contraction form, and simultaneously the contractions become deeper and progress toward the distal end of the stomach. During *early diastole* the waves of contraction continue to progress distally, but they gradually become more and more shallow, until in *mid-diastole* each wave of contraction disappears or becomes most shallow after having progressed distally to the point of origin of the neighboring wave. During the *latter half* of diastole the peristaltic contractions are at their minimum.

Systole and diastole of the pyloric canal is a function of the fan-shaped pyloric muscle. During systole this muscle contracts concentrically to the long axis of the pyloric canal. At the onset of diastole, relaxation of this muscle is rapid and causes the appearance of the anti-peristalsis described by Alvarez. Systole of the pyloric canal occurs during the period of diastole of the upper division of the stomach, and diastole of the pyloric canal occurs just after the onset of systole of the upper division. Two of the ten phases of the gastric cycle have been selected to illustrate the lumen of the stomach—one with the upper division of the stomach in systole (Fig. 31), and the other with the pyloric canal in systole (Fig. 32). These are also illustrated in the line drawings in Figures 26 and 27. Approximately one and one-half gastric cycles are recorded in the roentgenocinematographic series, Figure 15.

Small Intestine.—The small intestine begins at the first plica circularis observed in the duodenum and terminates at the ileocecal valve. There are two main divisions of the small intestine (1) the duodenum, which is largely retroperitoneal in position and relatively fixed, (2) the mesenteric small intestine, which is interperitoneal and, because of its mesentery, relatively movable.

On the basis of relative differences in the mucosa the mesenteric small intestine has been further divided into the jejunum, which is proximal, and the ileum, which is distal. Although the difference in the mucosa of the proximal part of the small intestine and the distal part of the small intestine is marked, there is no abrupt dividing line and the transition from characteristic jejunum to characteristic ileum is gradual. This division of mesenteric small intestine into jejunum and ileum does not, apparently, have a good anatomical basis. Most anatomists prefer to speak of this part of the small intestine as a unit, calling it either the jejunum-ileum or, preferably, the mesenteric small intestine.

During a detailed roentgenographic study of the small intestine, a report of which was published in 1927, we had noticed in the great majority of individuals that the small intestine was arranged in a definite pattern of groups of coils. We were not satisfied with the usual classification of the small intestine into jejunum and ileum because of the absence of any sharp difference between those regions of the small intestine which are supposed to show the greatest variation, namely, the small intestine near the duodeno-jejunal flexure, and the small intestine near the ileocecal valve. We were considering a division of the small intestine according to its arrangement into groups of coils when we learned that such a classification was entirely logical, in that the small intestine develops in the embryo in this manner, and at a very early stage of development shows this typical arrangement into groups of coils. At this time we had not recognized that the loops of the duodenum represented part of this general arrangement. C. M. Jackson, in his section on the digestive system in Morris's "Human Anatomy," states as follows: "Even in an embryo of 19 mm., while the intestine is still in the umbilical celom, Mall described six primary coils of the small intestine which could be usually identified even in the adult. In the adult, as also through the various stages of development, Loop 1 forms the duodenum." From our own studies

we believe that the groups of intestinal coils developing from these six primary coils can be recognized roentgenographically (Fig 38). The first loop (Fig 39) is the duodenum and should be known under that name. The second, third, fourth, fifth, and sixth groups of coils are the mesenteric small intestine. We believe that these several groups of coils can be recognized roentgenographically and that any roentgenologic division of the mesenteric small intestine should be on this basis of development.

Duodenum.—We consider that the duodenum begins at the first crescentic or annular fold of the mucosa distal to the cap, and extends to the duodenjejunal flexure. The duodenum is relatively fixed in position in the form of a loop, the opening of the loop facing to the left and superiorly. The concavity of the loop encircles the head of the pancreas and corresponds in size to it. There are several normal shapes of the loop of the duodenum. Depending upon the relative position and angulation of the superior, descending and inferior parts, the duodenum may be shaped like the capital letters "C," "V," or "U," or may be almost rectangular in shape.

The superior or first part of the duodenum, not the cap, is not retroperitoneal and is usually short. It is best visualized in the right oblique projection (Fig 48). This superior part of the duodenum passes from the distal end of the cap posteriorly and usually superiorly and to the right. The angle at the inferior margin of the junction between the cap and superior duodenum may be obtuse or acute. The more the stomach is raised upward and forward by the abdominal contents, the more obtuse is the angle. In marked elevation of the stomach or in the short typical hypersthenic type of stomach, the cap may point inferiorly into the superior duodenum. This is inversion of the cap. The superior duodenum may be long and occasionally forms a loop inferiorly (Fig 48), the cap and the upper end of the descending duodenum forming the two points of suspension. The folds of the mucosa within the short superior duodenum are usually low in height and few in number. This relative absence of folds is particularly noticeable when the superior duodenum is long and redundant. The superimposition, partial or complete, of a redundant superior duodenum over the cap, as occurs in the anteroposterior projection, produces an irregular shadow which may closely simulate a deformity of the cap due to ulcer (Fig 47).

The descending and inferior parts of the duodenum are relatively fixed in position. This fixation is, however, more relative than absolute, and the position and form of the duodenum usually differ in the prone and erect postures of the individual. The anterior and lateral walls of the duodenum are covered by peritoneum, protrude into the peritoneal cavity, and are relatively free. For this reason the contour will vary considerably with varying degrees of filling. The transverse mesocolon crosses the middle of the descending duodenum, and at this level one not infrequently sees deformation and angulation of the descending duodenum (Figs 49 and 50). This is a congenital malformation acquired at the time that rotation and fixation of the colon occurred.

Duodenjejunal Flexure.—This is usually the highest fixed point of the

small intestine. The inferior duodenum usually ascends to the flexure. The flexure is suspended by the fibromuscular ligament of Treitz which passes down behind the pancreas from the lumbar part of the diaphragm. Very rarely one finds an abnormal location of the duodeno-jejunal flexure, in which case fixation has usually occurred lower in position, somewhere along the normal course of the inferior duodenum.

The intestine is only occasionally held to a point at the duodeno-jejunal flexure. Usually it makes a moderate curve on itself, and less commonly the curve is very wide. The curve at the flexure is usually from posterior to anterior, and for this reason, in many individuals, the angle of the curve can be appreciated best when it is viewed in the oblique or lateral direction. From the duodeno-jejunal flexure the intestine passes forward and usually inferiorly toward either the right or left side. This first loop of the mesenteric small intestine is more commonly directed inferiorly, or inferiorly and to the left, than it is toward the right side. Occasionally the intestine, a short distance distal to the flexure, is caught up at a second point of fixation, forming a short loop.

Mesenteric Small Intestine.—The second group of coils, which forms the first part of the mesenteric small intestine, is usually located in the left hypochondrium and the loops may ascend above the level of the duodeno-jejunal flexure (Fig. 40). The third group of coils is usually located in the left lumbar region and the loops may descend below the plane through the level of the superior iliac spines (Fig. 41). Almost uniformly, both of these groups extend slightly beyond the right side of the spine. It is uncommon, however, to observe several loops of these groups in the right hypochondriac regions. The various loops of these groups are usually quite discrete, particularly when they are widely distributed in the abdomen. Only when they are confined within a relatively small area are they massed together so that the individual loops cannot be recognized.

The fourth group of coils is usually found in the umbilical and upper hypogastric regions (Fig. 42). The fifth group of coils is usually observed in the right lumbar region (Fig. 43) and the sixth group of coils is usually located in the right iliac fossa and the false pelvis, or lower hypogastric region (Figs. 44 and 45). Distinct visualization of the separate loops of the fourth, fifth, and sixth groups largely depends upon their position in the abdomen. If most of the loops are out of the pelvis, they can be individually recognized. When the loops are grouped together in the pelvis they may be so massed together that it is impossible to recognize their outlines. Upward displacement of the intestines by a filled urinary bladder also tends to mass the loops together. This tendency in many individuals for the groups of coils to be massed together is the most serious obstacle we have encountered in attempting accurately to visualize the small intestine.

There is also a characteristic arrangement of the intestinal loops within the groups of coils. In the second and third groups of coils the individual loops lie transversely in the abdomen, and in the fourth, fifth, and sixth groups the individual loops lie vertically. Between each group of coils a rela-

tively longer loop of small intestine extends back to the root of the mesentery. This formation is most characteristically seen between the second and third groups of coils (Figs. 39 and 40).

Displacement of the first and second groups of coils into the right hypochondrium and lumbar region is the rule in association with incomplete rotation of the colon. Rarely it occurs as an isolated abnormality. In both instances the duodeno-jejunal flexure may be displaced out of its usual position. Another unusual anomaly is to have the upper loops of the mesenteric small intestine festooned across the upper abdomen.

The surface of the mucosa of the small intestine is characterized by the presence of numerous circular, spiral, and crescentic folds. These folds, which are most commonly called the *plicae circulares*, are found throughout the small intestine but are most numerous and of greater height in the duodenum and first loops of the mesenteric small intestine. They diminish somewhat in height and number through the fourth and fifth groups of coils. In the sixth group of coils they are short and less numerous and may be absent in the terminal part. The folds are possibly of two types: (1) the permanent folds, that is, those which persist during distention of the intestine and persist in the anatomical specimen (these are a duplication of the mucosa and muscularis mucosæ, bound together by the submucosa), (2) those folds which are due to temporary contraction of the muscularis mucosæ. Forssell has called attention to the varying form of the folds of the duodenum and ascribes this to varying contraction of the muscularis mucosæ. More recently Forssell has brought forward a more complicated theory regarding the movements of the mucosa which shall be discussed at a more appropriate time.

Caliber of the Lumen of the Small Intestine—In the living subject the intestine is normally in a state of tonic contraction—it is contracted on itself or its contents. For this reason the caliber of the lumen of any section of the small intestine will depend largely upon the degree of filling or distention. Certain normal variations in the rapidity of emptying of the stomach and the rapidity of passage of the meal through the small intestine will, therefore, modify the distribution of the meal and the appearance of the intestine. Rapid uniform emptying of the stomach will give a large caliber to the intestine throughout the entire length in which the meal is present. With slow or moderately rapid emptying of the stomach the caliber of the lumen of the intestine will be small or moderate, if the passage of the meal through the intestine keeps pace with the emptying of the stomach. If the passage of the meal through the intestine is more rapid than the entrance of the meal into the intestine, the caliber will be small, but usually uniform. If the stomach empties itself intermittently, the distribution of the meal and the caliber of the small intestine will be irregular.

Ileocecal Valve—The small intestine opens into the colon through the ileocecal valve, usually situated on the left posterior side of the proximal end of the colon, and marking the dividing line of the cecum and ascending colon. The valve has two lips, one superior and one inferior. From the anterior and posterior margins of the valve, where the lips meet, a fold (frenulum) which

protrudes into the lumen of the gut, extends partially around the inside of the colon. The indentation of the barium column produced by these folds is not infrequently observed in the roentgenograms of this region. The roentgenographic appearance of the lumen of the open valve as viewed in the postero-anterior direction is illustrated in Figure 46.

Coats of the Stomach and Small Intestine.—As we stated in a recent communication (1928), dealing with the gross morphology of the living stomach and the microscopic anatomy of the stomach (with some reference to the cap), all portions of the gastro-intestinal tract have been described by anatomists as having five coats, namely, (1) mucosa, (2) muscularis mucosæ, (3) submucosa, (4) muscular coat (composed of two or three layers), and (5) the serous coat. These coats differ in thickness and characteristics in various regions of the stomach. In the small intestine their histologic structures vary in different portions to a less degree than in the stomach. Strangely enough, in the last two decades the cap—although the subject of a great deal of controversy—has escaped an intensive investigation of its gross and microscopic anatomical structure, particularly the peculiarities of structure as compared with those of adjacent regions. In the cap there are only three coats. It is very important to have a thorough understanding of the anatomical characteristics of each of these coats in the various regions.

In the stomach (Fig. 51) the mucosa is packed closely with tubular glands. The muscularis mucosæ is a well defined coat firmly fixed to the bases of the tubular glands of the mucosa, and in places continuous with slips of muscle tissue which extend in between the tubular glands. The submucosa has a loose areolar character, permitting the free movement of the mucosa on the regular muscle coat. It is rich in a vascular network that supplies blood to the mucosa on the one side, and to the muscular coat on the other. The muscular coat is very thin in some regions and extremely thick in others. The serous coat is firmly attached to the muscular coat except on the greater and lesser curvatures, but it is important to note that the serous coat draws its blood supply from vessels totally different from those which provide blood to the underlying muscular coat.

Both the sulcus angularis and the pyloric valve are thin muco-membranous folds which consist of mucosa, the muscularis mucosæ, and submucosa. The thickness at the base of both the sulcus angularis and the pyloric valve is just sufficient to contain two layers of mucosa, two layers of muscularis mucosæ, and a core of submucosa. It is obviously impossible for them to contain the definitely thickened fibers of the circular muscular coat of the stomach. Closure of the pyloric valve is caused by a circular contraction of the muscularis mucosæ (Fig. 52). The pyloric valve is not controlled by any specialized pyloric sphincter derived from the circular layer of the muscularis propria. The circular fibers of the muscularis propria terminate just at the base of the pyloric valve, and during the stage of relaxation the distal edge of this thickened muscle is contiguous with the base of the pyloric valve, but does not project down into the valve.

At the junction of the cap and pyloric valve, that is, at the distal side of

the pyloric valve, there is an abrupt change in all of the coats (Fig 52) The mucosa with its characteristics of the pyloric antrum covers both the proximal and distal surfaces of the pyloric valve, and the antral characteristics of the mucosa terminate suddenly at the base of the cap, where the deep tubules of Brunner's glands replace the bulk of the loose areolar submucosa The muscularis mucosæ terminates abruptly as a continuous layer, and splits up into thin strands which are lost in the connective tissue stroma between the straight superficial stalks of the glands and their deeper convoluted racemose tubules

As compared with the stomach, the muscularis propria of the cap is thin and incomplete It is composed largely of longitudinal fibers which are a continuation of the longitudinal muscle coat of the stomach The circular layer of the muscularis propria of the stomach terminates at the distal end of the thick fan-shaped muscle of the pyloric canal Distal to this there is no circular layer of muscle until about the middle of the cap

The junction of the cap and small intestine (duodenum) is marked by the first annular or crescentic fold (*plica circularis*) distal to the pyloric valve The loose, areolar submucosa and the muscularis mucosæ are re-established at this point, which allows folds of the mucosa to form by contraction of the muscularis mucosæ The number of coats in the small intestine is also five, and they are arranged similarly to those of the stomach, without, however, as stated above, as much variation in their structure

In the cap, therefore, the structure of the wall of the gut differs considerably from the structure of the wall of the stomach and small intestine (Fig 53) The submucosa as a loose areolar structure and the muscularis mucosæ are absent, being replaced by the bulky racemose convoluted glands of Brunner, and these glands lie in direct contact with the inner surface of the muscular coat Because of the absence of a loose areolar submucosa the mucosa is relatively immovable upon the muscle coat The muscularis propria of the cap is relatively thin, particularly in a local region which completely encircles the cap about one-fourth of an inch distal to the pyloric valve In this local region (Fig 52, X) the muscular coat is diminished from 40 to 98 per cent, leaving in some cases only 2 per cent of muscle, according to Howell On the ventral surface of the cap the peritoneum is tightly adherent to the muscularis propria Posteriorly, a space similar to the intraperitoneal gastric triangle is present between the dorsal surface of the cap and the descending duodenum The blood supply of the cap is derived from both the pyloric branch of the right gastric artery and the gastroduodenal artery The branches of both of these arteries terminate in end arteries, (1) in the local region just distal to the pyloric valve where the muscle coat is extremely thin, (2) in the pyloric valve itself, and (3) in the extreme distal end of the pyloric canal just proximal to the valve

It would appear from the peculiar characteristics of this local region of the cap, namely an area from which two coats are absent (muscularis mucosæ and submucosa), where the musculature is thinner than in any other part of the gastro-intestinal tract, where the mucosal glands change abruptly from a

straight tubular to a racemose type of gland, and where the pyloric and duodenal arteries terminate in end arteries, that this region would present findings of more than academic interest. In fact, the anatomical structures in this region form a vulnerable ring or collar which, as indicated by the facts, represents the point of junction of the foregut and midgut during an early embryonic stage of development. The irregularities are those presented by two laminated structures improperly welded together. We regard the findings in this area as not only important from the pathologic, surgical, and roentgenologic standpoints, but also as anatomical factors predisposing to ulcer of the cap, and of great importance in the life history of ulcer of the cap.

The Colon.—The normal colon (Figs. 54-57) may be divided into six easily recognized regions, the cecum, the ascending, transverse, and descending colons, the sigmoid, and the rectum. Each has individual roentgenologic characteristics. There are two important flexures, the hepatic and splenic. The colon almost completely encircles the abdominal cavity from the situation of the cecum in the right iliac region to the situation of the rectum in the middle posterior part of the pelvis. The normal colon of all individuals conforms in general to a definite pattern or type, although every colon is prone to show some slight variation. The length of the colon varies considerably, both absolutely in different individuals and relatively in the same individual, depending upon the degree of contraction and relaxation of the colon. When the length of the colon is absolutely increased over the usual normal, the increase may be evenly distributed over the various divisions of the colon, but it is more usual for the increase in length to be limited to one or two divisions.

As regards the usual location of the various divisions of the colon, the cecum lies in the right iliac fossa. The ascending colon extends upward from the cecum along the right side of the posterior wall of the abdomen to the under surface of the liver. Here, at the hepatic flexure, the colon bends sharply forward and to the left. The next division, the transverse colon, extends to the splenic flexure. The transverse colon is festooned across the abdomen, suspended by the fixation at the hepatic and splenic flexures and through the gastro-colic ligament and mesocolon, and lies anterior to the small intestine. In the left hypochondrium at the splenic flexure the colon bends sharply posteriorly and inferiorly, from which point the descending colon passes inferiorly, lying along the left side of the posterior abdominal wall, to the left iliac fossa. There is usually no sharply defined point of transition between the descending and sigmoid colon, and for sake of clearness it is probably best to use the crest of the left ilium as the line of transition, below which the colon is termed the sigmoid colon. At approximately the brim of the true pelvis the sigmoid colon acquires a mesentery and, because it is longer than its mesenteric attachment, assumes the form of a loop. The sigmoid terminates in the rectum just below the promontory of the sacrum at the level of the body of the third sacral segment. The rectum extends inferiorly, following the curve of the sacrum, and at the floor of the pelvis bends posteriorly and passes through the floor of the pelvis as the anus.

The caliber of the colon varies directly with the volume of its contents.

the pyloric valve, there is an abrupt change in all of the coats (Fig 52) The mucosa with its characteristics of the pyloric antrum covers both the proximal and distal surfaces of the pyloric valve, and the antral characteristics of the mucosa terminate suddenly at the base of the cap, where the deep tubules of Brunner's glands replace the bulk of the loose areolar submucosa The muscularis mucosæ terminates abruptly as a continuous layer, and splits up into thin strands which are lost in the connective tissue stroma between the straight superficial stalks of the glands and their deeper convoluted racemose tubules

As compared with the stomach, the muscularis propria of the cap is thin and incomplete It is composed largely of longitudinal fibers which are a continuation of the longitudinal muscle coat of the stomach The circular layer of the muscularis propria of the stomach terminates at the distal end of the thick fan-shaped muscle of the pyloric canal Distal to this there is no circular layer of muscle until about the middle of the cap

The junction of the cap and small intestine (duodenum) is marked by the first annular or crescentic fold (*plica circularis*) distal to the pyloric valve The loose, areolar submucosa and the muscularis mucosæ are re-established at this point, which allows folds of the mucosa to form by contraction of the muscularis mucosæ The number of coats in the small intestine is also five, and they are arranged similarly to those of the stomach, without, however, as stated above, as much variation in their structure

In the cap, therefore, the structure of the wall of the gut differs considerably from the structure of the wall of the stomach and small intestine (Fig 53) The submucosa as a loose areolar structure and the muscularis mucosæ are absent, being replaced by the bulky racemose convoluted glands of Brunner, and these glands lie in direct contact with the inner surface of the muscular coat Because of the absence of a loose areolar submucosa the mucosa is relatively immovable upon the muscle coat The muscularis propria of the cap is relatively thin, particularly in a local region which completely encircles the cap about one-fourth of an inch distal to the pyloric valve In this local region (Fig 52 X) the muscular coat is diminished from 40 to 98 per cent, leaving in some cases only 2 per cent of muscle, according to Howell On the ventral surface of the cap the peritoneum is tightly adherent to the muscularis propria Posteriorly, a space similar to the intraperitoneal gastric triangle is present between the dorsal surface of the cap and the descending duodenum The blood supply of the cap is derived from both the pyloric branch of the right gastric artery and the gastroduodenal artery The branches of both of these arteries terminate in end arteries, (1) in the local region just distal to the pyloric valve where the muscle coat is extremely thin, (2) in the pyloric valve itself, and (3) in the extreme distal end of the pyloric canal, just proximal to the valve

It would appear from the peculiar characteristics of this local region of the cap, namely, an area from which two coats are absent (muscularis mucosæ and submucosa), where the musculature is thinner than in any other part of the gastro-intestinal tract, where the mucosal glands change abruptly from a

over a long area to expel its contents (Figs 58 and 59) The lowest level of the festoon of the transverse colon depends upon several factors (1) the general build of the individual, (2) the length of the transverse colon, (3) the height of fixation of the hepatic and splenic flexures, and (4) the degree of filling of the transverse colon All of these factors must be taken into consideration in determining the possible clinical importance of a low transverse colon One must always bear in mind that the position of certain abdominal organs will depend upon the size, movability, and solidity of the organ itself, and upon the size and shape of the available space which it may occupy An abnormally short transverse colon will press upon the posterior surface of the stomach and produce a cascade type of stomach

Hepatic and Splenic Flexures—We know from the roentgenographic studies of the colon of many individuals by means of the barium meal and the barium enema, and with the colon filled with varying amounts of an opaque suspension, that the degree of fixation and the height of fixation of these flexures is markedly varied, and that the flexures may change position in the same individual The position of the hepatic flexure varies the least both in different individuals and in the same individual Usually it bears a fairly constant relation to the lower surface of the liver, and is displaced inferiorly by enlargement of the liver, both anteriorly and inferiorly by a growth developing in the tissues posterior to it, and by any considerable enlargement of the right kidney

The splenic flexure generally lies at a higher level than the hepatic flexure, but is as a rule more freely movable, and in a few cases lies at a lower level than the hepatic flexure Only rarely is the splenic flexure as high as the diaphragm, and in these few cases there is an abnormally firm fixation of the splenic flexure to the under surface of the diaphragm

Descending and Sigmoid Colon—The descending colon is normally not provided with a mesentery and is quite firmly fixed in position The descending colon follows a fairly straight course and the only common variation is a short anterior looping which is fairly frequently present just above the crest of the left ilium

In the left iliac fossa about two inches below the level of the crest of the ilium the colon is very frequently covered by a peritoneal band which limits the expansibility of this part of the colon (Fig 65) This occurs just above the point where the mesentery of the sigmoid colon begins, and is frequently used as a landmark to establish the division between the descending and sigmoid colon An excellent drawing of an anatomical specimen showing this condition from Piersol's 1911 edition of Quain's "Human Anatomy," is reproduced here (Fig 64)

The form of the sigmoid colon varies more than that of any other part of the colon Its simplest form is a short loop Depending upon its length and the length of its mesentery, it assumes many bizarre forms and occupies various positions It may lie coiled entirely within the lesser pelvis, and yet we have seen a long loop of the sigmoid reach to as high a level as the splenic flexure

The potential caliber is apparently largest in the cecum and proximal part of the ascending colon and the rectum. When the colon is evenly filled with the usual one to two liter (quart) enema, the caliber diminishes gradually from the cecum to the lower part of the sigmoid, and is then increased in the rectum.

Cecum—The cecum is usually covered on all sides with peritoneum. The form of the cecum is variable, the most extreme variation being a long cecum which tapers directly into the appendix. The well filled normal cecum will usually show an indentation at its inferior border corresponding to the site of the anterior band of longitudinal muscle. The cecum most commonly lies in the right iliac fossa, but varies considerably and may lie above the crest of the right ilium or deep in the pelvis. This variation in position is largely due to variations in length of the ascending colon. An abnormally movable cecum, cecum mobile, occurs when the ascending colon is provided with a mesentery. Situation of the cecum on the right side of or posterior to the ascending colon is the result of an incomplete or arrested descent of the cecum. In these cases the appendix is almost always fixed at a higher level than is the cecum.

Ascending Colon—The anterior and both lateral walls of the ascending colon are covered with peritoneum, but the posterior wall lies directly on the fascia over the psoas and quadratus lumborum muscles. There is normally no mesentery. The ascending colon, conforming to the posterior abdominal wall, forms a posterior curve which is best appreciated when the colon is viewed from the side (Fig. 56). When this curve is marked, as is not infrequently the case, a considerable part of the ascending colon may be concealed in the usual anterior or posterior roentgenographic projection.

Congenital veils are very commonly present in relation to the ascending colon. Usually these are broad, thin veils which deform slightly the contour of the colon without producing any stenosis and without limiting seriously the expansibility of this part of the colon. In some instances the veil is not limited to the ascending colon, but extends to the distal loop of the hepatic flexure and the proximal part of the transverse colon, holding the ascending colon and the proximal part of the transverse colon in close apposition and producing a sharp angulation of the colon at the hepatic flexure. Very rarely, instead of a thin, diffuse veil, there will be a narrow, localized, dense band which constricts the colon and causes a definite stasis proximal to the point of constriction. These may be acquired during life due to an inflammatory process, but are more commonly congenital anomalies, probably abnormal fixations of the omentum.

Transverse Colon—The transverse colon, normally slung like a hammock between the hepatic and splenic flexures and attached to the posterior abdominal wall by the long transverse mesocolon, is the most freely movable part of the colon. The transverse colon varies markedly in length in different individuals, and in the same individual shows a marked difference in length at various stages of filling and contraction. In this part of the colon one may see most clearly the shortening of the colon which occurs when it contracts

contractions which originate in the tonically contracted muscle of this tract. A second physiological function is the origin in this tract of waves of contraction which pass distally and convey the fecal contents into the more distal parts of the colon. In our own material we have occasionally observed an area of tonic contraction in this part of the ascending colon (Fig. 62). In one case in particular (Fig. 63) it was a persistent finding and the site of origin of repeated, extensive contractions of the more distal part of the colon, and was, apparently, the functional source of a marked diarrhea which occurred with any worry or excitation. The findings obtained from studies of the colon by means of the barium enema also show that in many cases the contraction of the colon which evacuates the enema begins at this point (Fig. 62). This is most commonly observed and is actually a source of difficulty when one attempts to keep the colon filled with a barium enema before the irritative effects of castor oil have disappeared. From our own findings we are unable to find any positive evidence of a sphincteric action. When the barium meal passes from the small intestine into the colon, it gradually fills the ascending colon in continuity, and is more likely to be carried over into the transverse colon at an early period than to linger in the cecum and proximal part of the ascending colon.

Cannon and other observers have described a normally recurring area of tonic contraction which arises in the proximal part of the transverse colon. In animal experiments, peristaltic waves of contraction which pass both proximally and distally have been observed as originating in this area of tonic contraction. Roentgenologically one quite frequently observes long waves of contraction which originate in the proximal part of the transverse colon and produce a mass movement of the fecal contents which has been described by Case and others. Contractions arising in this region are more frequently observed in the forward passage of the barium meal than in the evacuation of the barium enema. An area of tonic contraction in the proximal part of the transverse colon is illustrated in Figure 61.

A less commonly observed sphincteric tract, which is apparently also a localized tonic contraction, is the rectosigmoid apparatus at the junction of the sigmoid colon and rectum.

(To be continued)

Rectum—The colon becomes fixed in position again in the posterior part of the pelvis at the level of the third lumbar vertebra, and continues inferiorly as the rectum. The rectum is characterized by the presence of three permanent transverse folds, the valves of Houston. One of these is situated on the right side, and the other two are on the left side, one above and one below the right fold. These folds, which are frequently viewed on edge in the roentgenograms, serve to demonstrate the second fundamental finding. At the floor of the pelvis the rectum terminates in its second portion, the anus, which is occasionally observed roentgenographically in the contracted state after evacuation of the barium meal or enema.

The wall of the colon, like the wall of the other parts of the digestive tract, is composed of five coats, namely, mucosa, muscularis mucosæ, submucosa, muscularis propria, and the serosa. This structure is illustrated in Figure 60, which shows one-half of a specimen of the colon cut longitudinally.

This specimen shows also the detailed structure of the semilunar folds which protrude into the lumen of the colon, dividing the lumen into sacculations or haustra. As this figure shows, these folds are composed of a reduplication of mucosa, muscularis mucosæ, and a core of submucosa. In only one region (Fig. 60-A) is there any drawing in of the muscularis propria. It is our conviction, from roentgenographic studies of the colon and from a study of specimens of the colon, that the semilunar folds which form the haustrations of the colon are actively formed by contraction of the muscularis mucosæ, and are not due to contraction of the muscularis propria, and also are not a passive formation due to contraction of the longitudinal bands.

Areas of Tonic Contraction of the Colon—Anatomical and physiological sphincteric tracts have been described in several areas of the colon which have an important bearing in relation to roentgenographic findings. These are not constant formations which can be found routinely in every case, and usually do not have easily demonstrated anatomical characteristics. According to Hirsch they may be recognized in fresh autopsy specimens and on surgical exposure during life as areas of contractions which have a lighter, pinker color than the adjacent areas of the colon. We have observed a similar appearance of the fan-shaped muscle of the pyloric canal. Interesting from a functional standpoint are the experimental findings of Cannon which show that any area of tonic contraction in the colon, whether occurring spontaneously or produced by local stimulation, may act as the origin of waves of contraction which pass distally or proximally from the area of tonic contraction. Spontaneously formed areas of tonic contraction are probably the "pacemakers" of Alvarez.

Hirsch (1924) called attention to the presence of a cecocolic sphincteric tract in the ascending colon about one to two and one-half inches above the ileocecal valve, which he was able to demonstrate roentgenographically and in anatomical specimens. He attributes to this tract the physiological function of retarding the outflow of the cecal contents into the ascending colon until such time as cecal digestion and absorption be complete. He claims that this function is due both to the sphincteric action of this tract and to anti-peristaltic

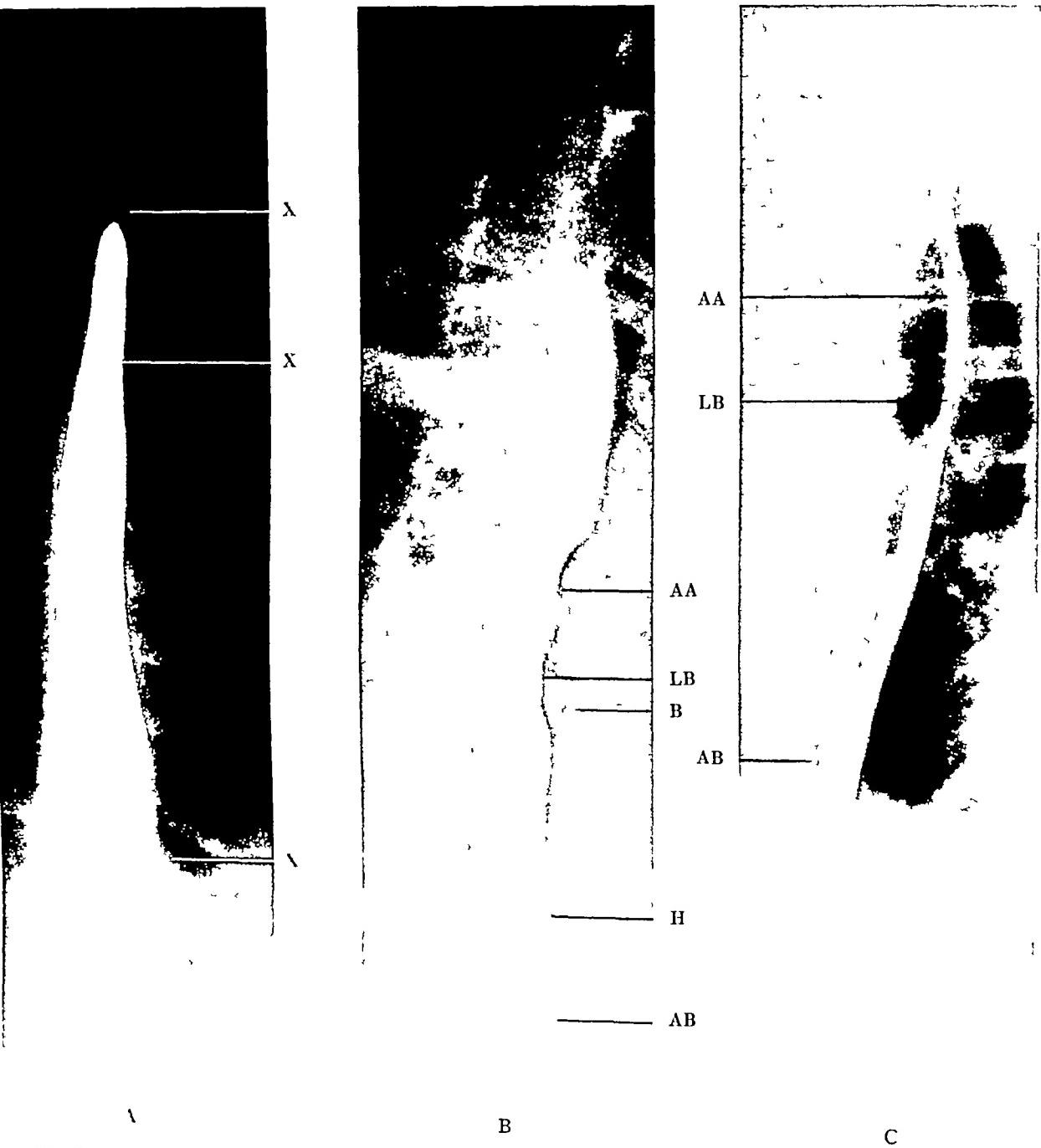


Fig. 20 Roentgenograms made in the anteroposterior (*A*) right oblique (*B*), and left oblique (*C*) projections of the esophagus. The use of these three projections enables one to observe the several profiles of the esophagus exactly as one would step around a tree to observe its curved surface.

A—Indentation of the arch of the aorta. *LB*—Indentation of the left main bronchus (*B*). *H*—Conformation to the contour of the heart. *X*—Anatomical points of narrowing. *AB*—Air bubble.

A and *B* were made with our routine gas tube technic the plate-target distance being 29 inches and the length of exposure 1/20 of a second. *C* was made in 1/40 of a second using a gas tube, 500 milliamperes and a target-plate distance of 42 inches.

Editor's Comment—It may not be amiss to call attention to the unusual excellence of the illustrations which constitute so valuable a part of this series of papers by The Cole Collaborators—Lewis Gregory Cole, M D , Robert Earl Pound, M D , Russell Wright Morse, M D , Courtenay I Headland, M D , William Gregory Cole, M D , and Ames W Naslund, M D These illustrations have been prepared under the close supervision of Dr Lewis Gregory Cole, for whom nothing short of the highest attainable degree of natural similitude has been achieved

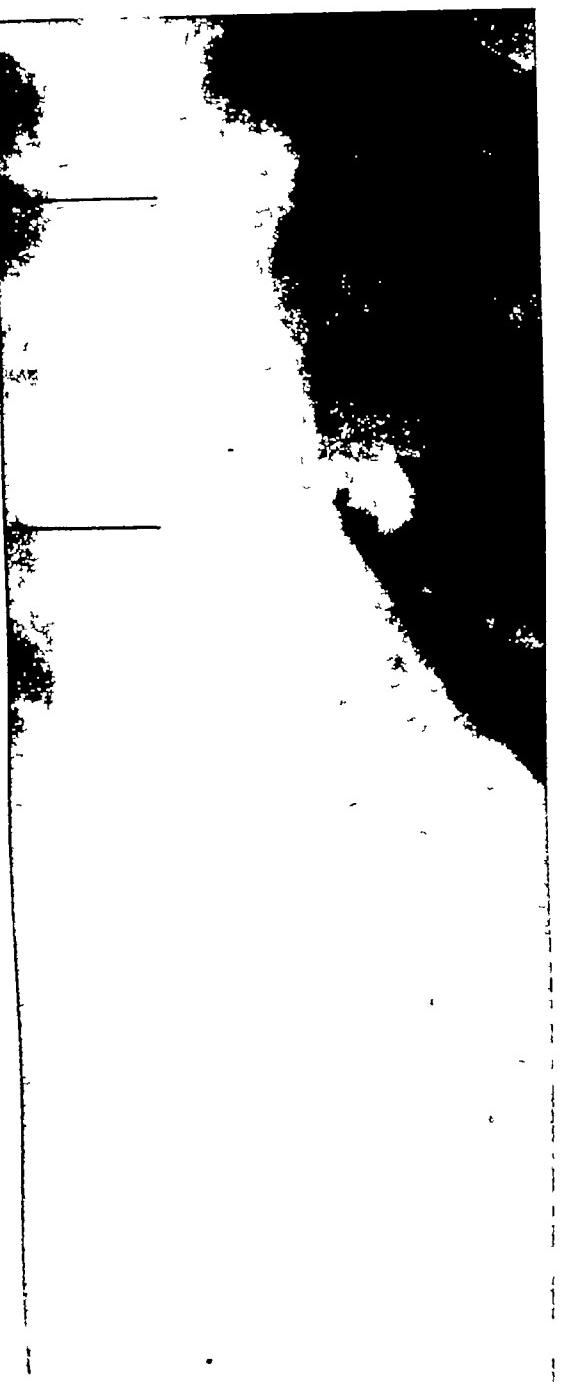


Fig. 22

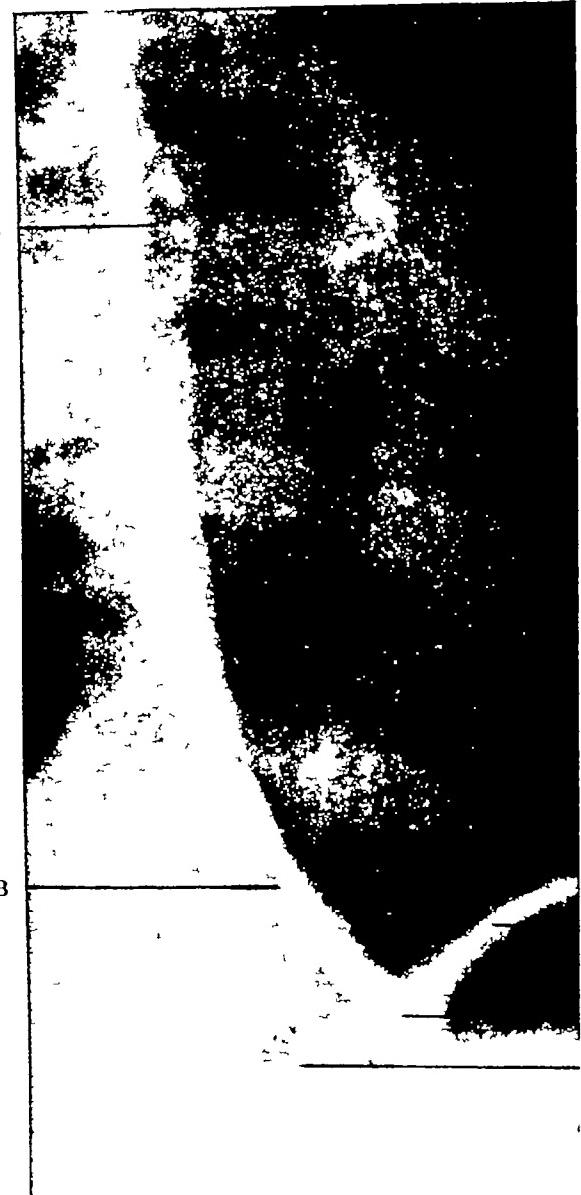


Fig. 23

Figs. 22 and 23 are roentgenograms which illustrate the appearance of air bubbles (*AB*) in the barium-filled esophagus. The air is swallowed and is carried down the esophagus ahead of a bolus of barium. The air either passes into the stomach or, after reaching the lower part of the esophagus, passes upward between the wall of the esophagus and the barium. As shown in these roentgenograms the appearance simulates very closely the displacement of the barium by an organic lesion protruding into the lumen of the esophagus. *AS*-Air bubble in fornix of stomach. *CO*-Cardiac orifice. *D*-Crux of left diaphragm. *F*-Barium adherent to superior wall of fornix. *14*-Indentation of the arch of the aorta.

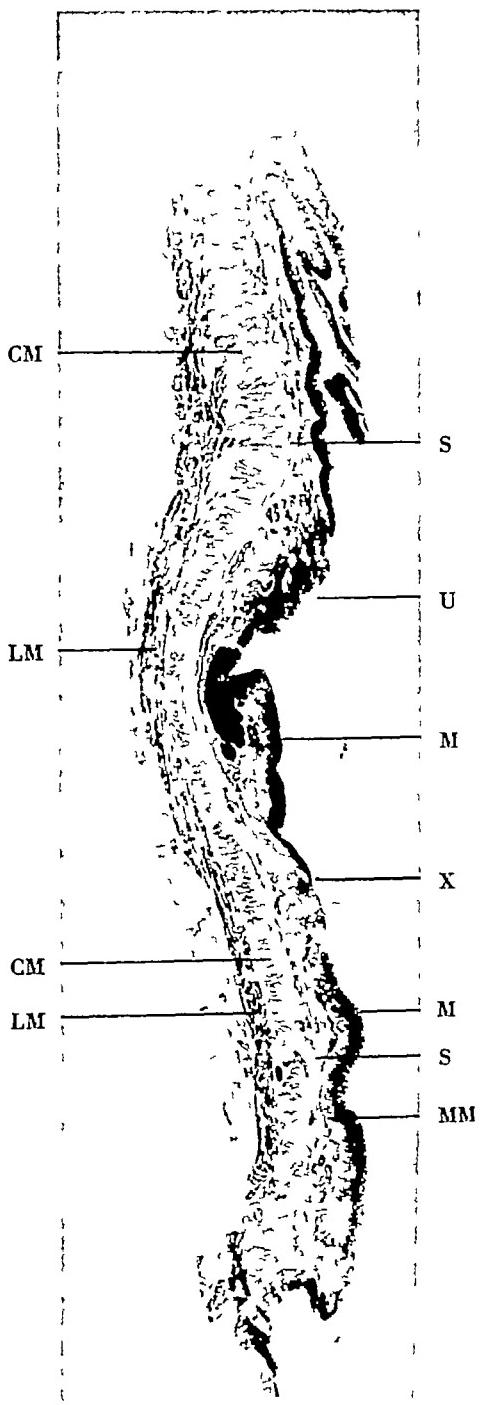


Fig 21 Photomicrograph of a longitudinal section through the lower part of the esophagus and the upper part of the lesser curvature of the stomach. At the junction of the esophagus and stomach (λ), the stained section shows the marked difference in appearance between the stratified squamous epithelium of the esophagus and the tubular glands of the gastric mucosa. There is no break in the structure of the other coats of the esophagus and stomach. At U there is an ulceration of the esophagus involving the mucosa and the submucosa. M —Mucosa. MM —Muscularis mucosae. S —Submucosa. CM —Circular layer of the muscularis propria. LM —Longitudinal layer of the muscularis propria.



Fig. 22



Fig. 23

Figs. 22 and 23 are roentgenograms which illustrate the appearance of air bubbles (*AB*) in the barium-filled esophagus. The air is swallowed and is carried down the esophagus ahead of a bolus of barium. The air either passes into the stomach or, after reaching the lower part of the esophagus, passes upward between the wall of the esophagus and the barium. As shown in these roentgenograms the appearance simulates very closely the displacement of the barium by an organic lesion protruding into the lumen of the esophagus. *AS*-Air bubble in fornix of stomach. *CO*-Cardiac orifice. *D*-Crux of left diaphragm. *F*-Barium adherent to superior wall of fornix. *I*-Indentation of the arch of the aorta.



Fig 24 Photograph of the outside of the stomach. The lumen of the specimen is filled with wax. *E*—Esophagus *F*—Fornix *COR*—Corpus *A*—Antrum *C*—Cap *D*—Duodenum *P*—Peritoneal covering over the intraperitoneal gastric triangle *R*—Recedent angle or *incisura angularis* on the lesser curvature of the stomach *X*—Reflection of the gastrohepatic ligament on the anterior surface of the stomach which simulates in appearance a 'wind-blown bob'

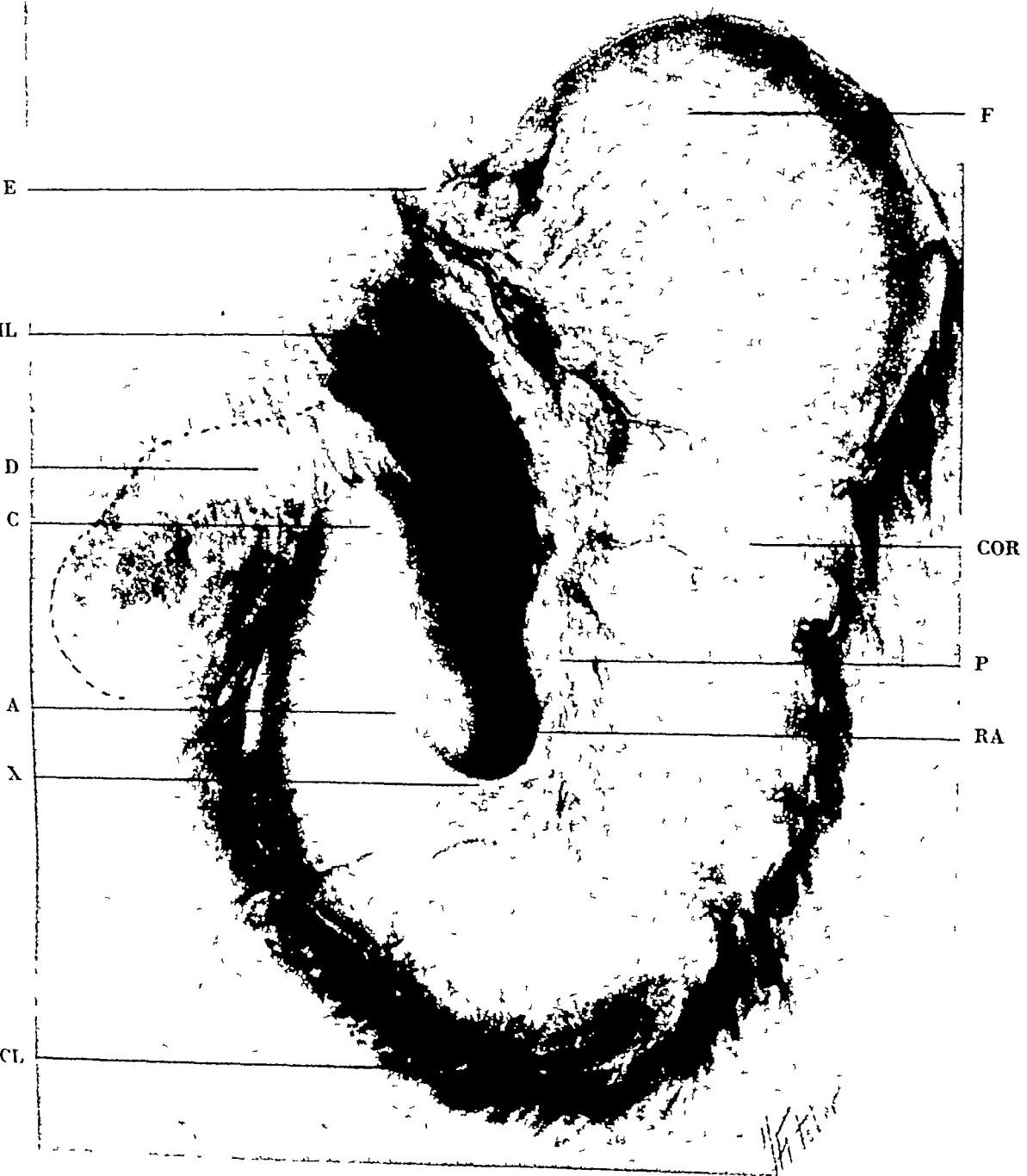


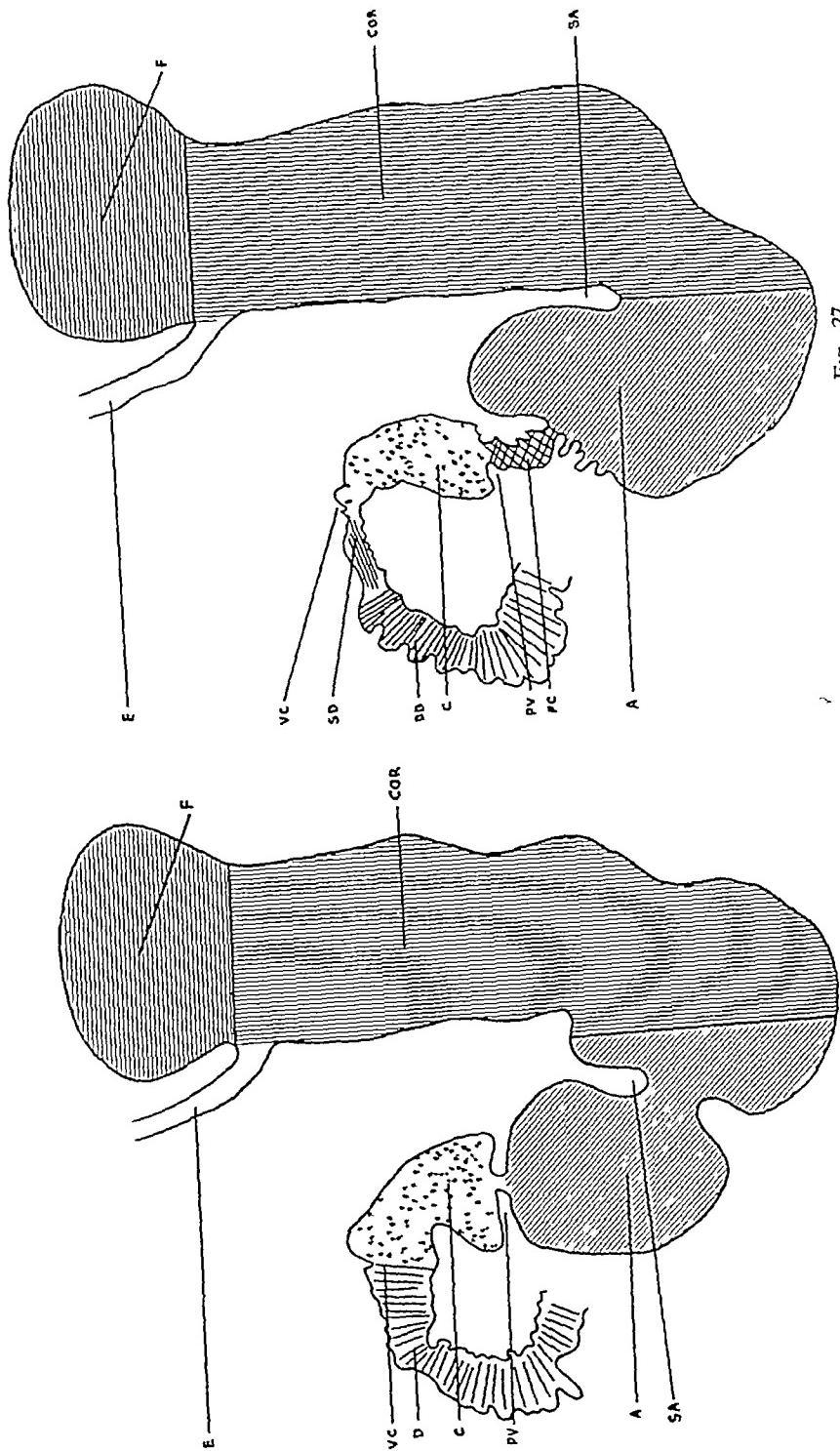
Fig 25 Drawing of the outside of the stomach *E*—Esophagus *F*—Fundus *COR*—Corpus
A—Antrum *C*—Cap *D*—Duodenum *GCL*—Gastro-colic ligament *GHL*—Gastro-hepatic ligament
P—Peritoneal covering over the intraperitoneal gastric triangle *RA*—Recedent angle or *incisura angularis* on the lesser curvature of the stomach *X*—Reflection of the gastro-hepatic ligament on the anterior surface of the stomach which simulates in appearance a 'wind-blown bob'

Figs 26 and 27 are tracings of roentgenograms of the same individual. The figures illustrate the change in outline of the stomach in two stages of the gastric cycle.

Fig. 26 shows systole of the stomach. Fig. 27 shows diastole of the stomach.

Fig. 26—*E*—Esophagus. *F*—Formic valve. *COR*—Corpus. *Vc*—Ventricular ligament. *D*—Anterior pyloric canal. *PV*—Pyloric valve. *PC*—Posterior pyloric canal. *A*—Antrum. *SA*—Junction of superior and descending duodenum.

Fig. 26
Fig. 27



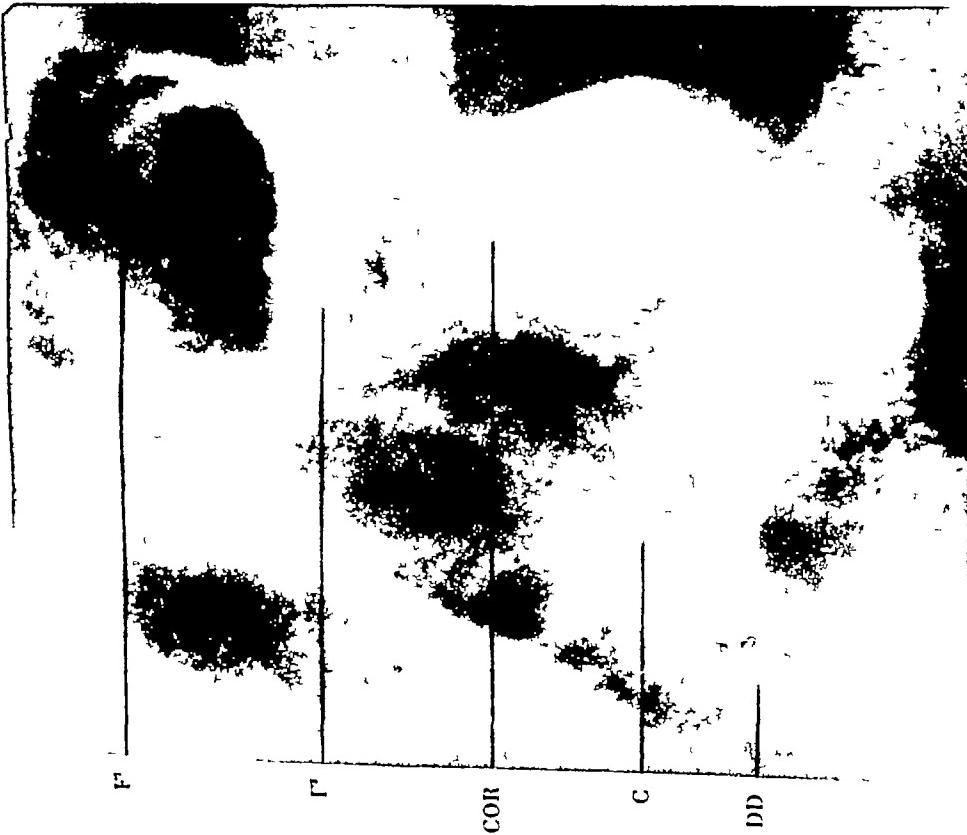


Fig. 28 Postero-anterior projection, erect posture

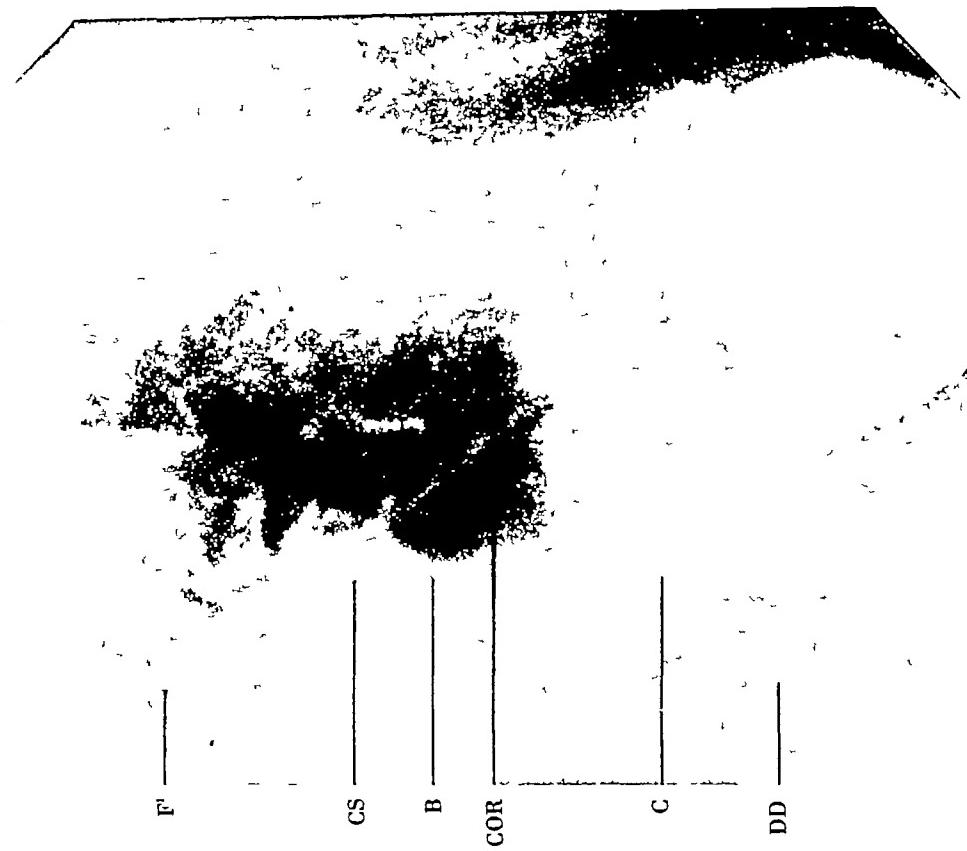


Fig. 29 Right oblique projection, erect posture

Figs. 28 and 29 are roentgenograms of the same individual which show the characteristic findings produced by a well-developed corporic shelf remnant in the oblique projection (Fig. 29, CS). Part of the fornix is at a lower level than the upper division of the corpus and part of the barium meal remains in this lower division of the fornix, as indicated at F' . In the postero-anterior projection the corporic shelf can not be seen, but the characteristic double shadow of barium meal and gas is shown distinctly present in the cascade type of stomach over a high transverse colon (F'). F' —Gas bubble in upper part of fornix. B —Barium in the lower part of the fornix. C —Cap. COR —Corporic shelf. CS —Corporic shelf remnant. DD —Descending duodenum.

Fig. 27

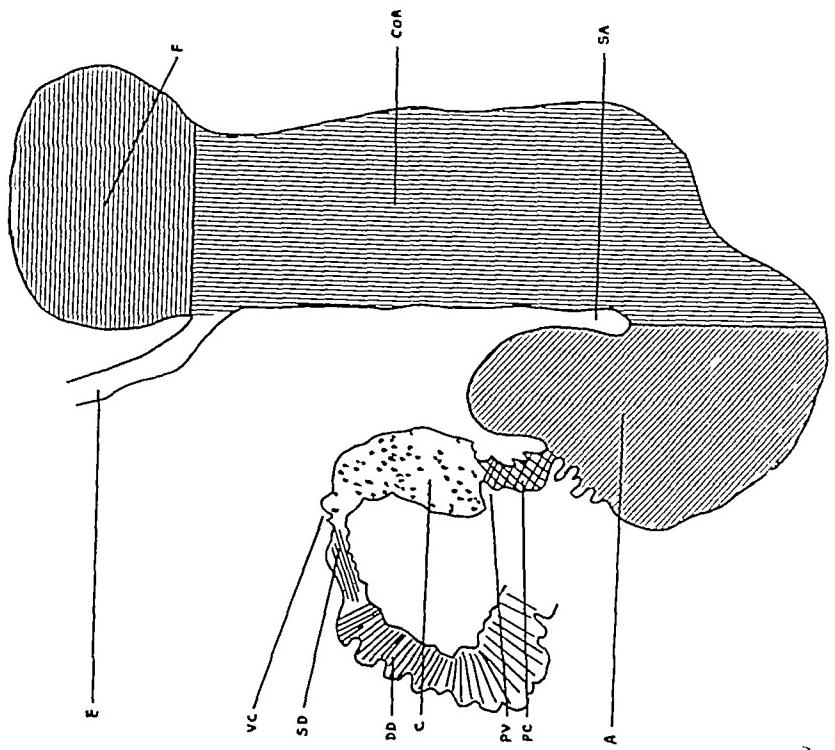
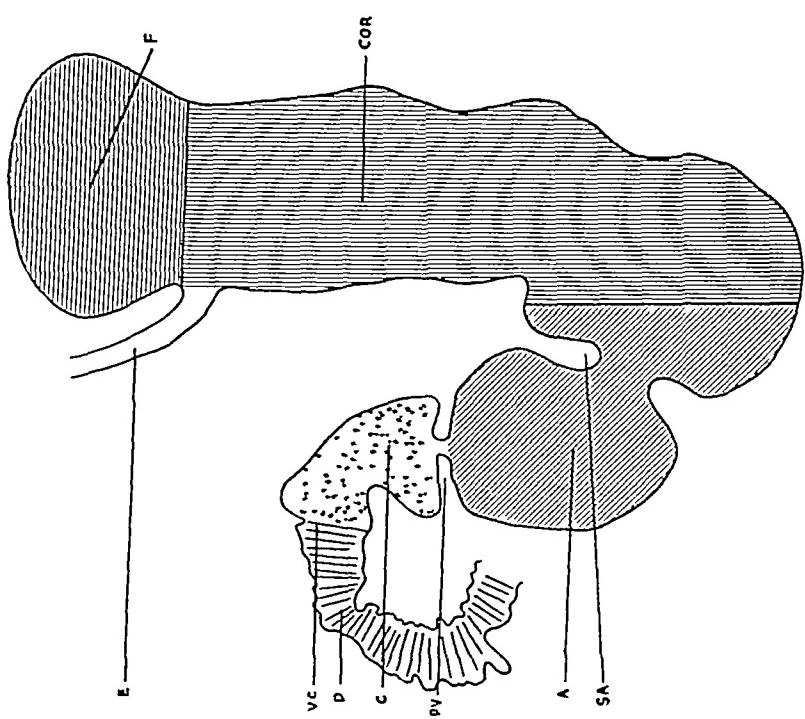


Fig. 26



Figs. 26 and 27 are tracings of roentgenograms of the same individual. The chambers of the stomach are mapped out by cross-hatching. Fig. 26 shows systole of the stomach. Fig. 27 shows diastole of the chambers of the stomach in two stages of the gastric cycle.
I.—Fundus
F.—Esophagus
COR.—Corpus
A.—Antrum
PV.—Pyloric canal
C.—Cardia
PC.—Pyloric valve
VC.—Capillary valve
D.—Junction of superior and descending duodenum

Fig. 32

Figs 31 and 32 are roentgenograms which show two stages of the gastro cycle and this is termed "diastole of the pyloric canal." The antrum is fully distended, more or less egg-shaped, and its outline is clear-cut and smooth. The cap (C) is separated from the antrum by the pyloric valve (PV). The base of the cap is wide and corresponds in contour with the adjacent portions of the antrum.

In Fig. 32 the pyloric canal (PC) is in the complete stage of contraction and, therefore, termed "complete systole of the pyloric canal." The barium content of the stomach within this region is evidenced by only a small accumulation of barium between the mucosal folds, which are squeezed together by the strong contraction of the circular fun-shaped muscle. The cap is very narrow at its base, corresponding in contour with the contracted pyloric canal. Compare the appearance of the lumen of the cap as shown in Fig. 36, where the pyloric canal is contracted by rigor mortis of the fun-shaped muscle. Bear in mind that it systole and diastole of the pyloric canal is not the same as systole and diastole of the stomach.

Fig. 31

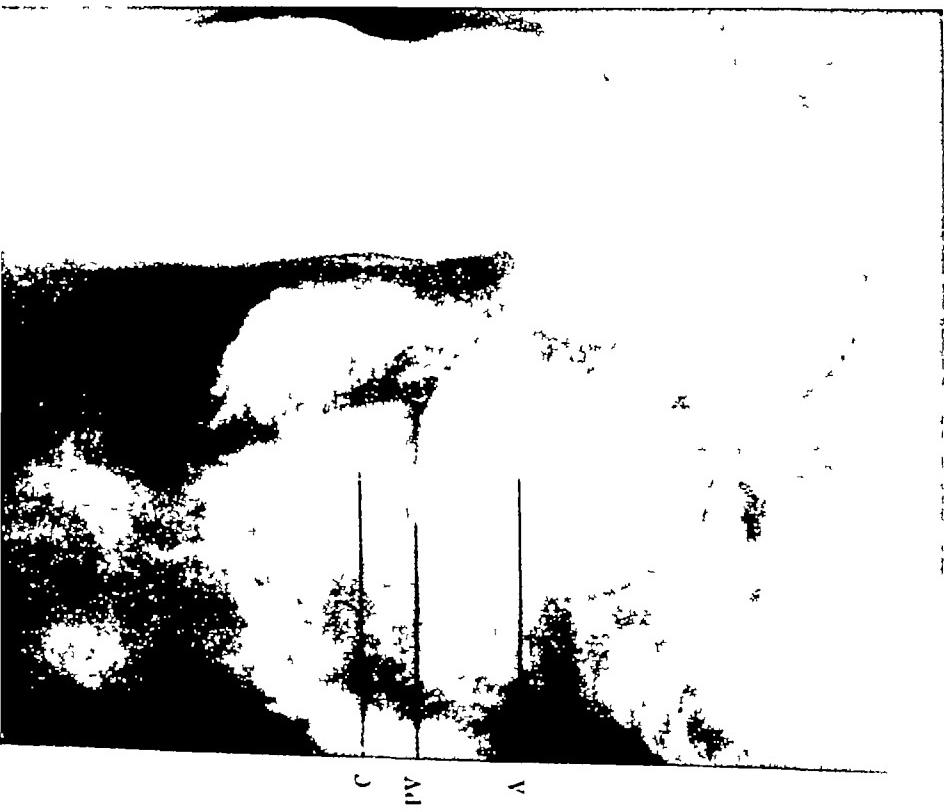


Fig. 32





Fig 30 Roentgenograms illustrating ten stages of a single cycle of the gastric motor phenomenon Peristalsis is of the four-cycle type

No 1 is the first stage of systole Nos 2 3 4, 5, and 6 are advancing stages of systole No 7 is the beginning of diastole Nos 8 and 9 are relaxing stages of diastole No 10 is complete diastole Nos 7 8 and 9 show concentric contraction of the fan-shaped muscle of the pyloric canal and No 10 shows the sudden relaxation of the fan-shaped muscle

Nos 1 to 10 show progressive filling of the cap during the gastric cycle and Nos 7 8 and 9 show the altered shape of the base of the cap due to the contraction of the fan-shaped muscle

For progression of the peristaltic wave one should note both the greater and lesser curvatures

Fig. 32

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Fig. 31

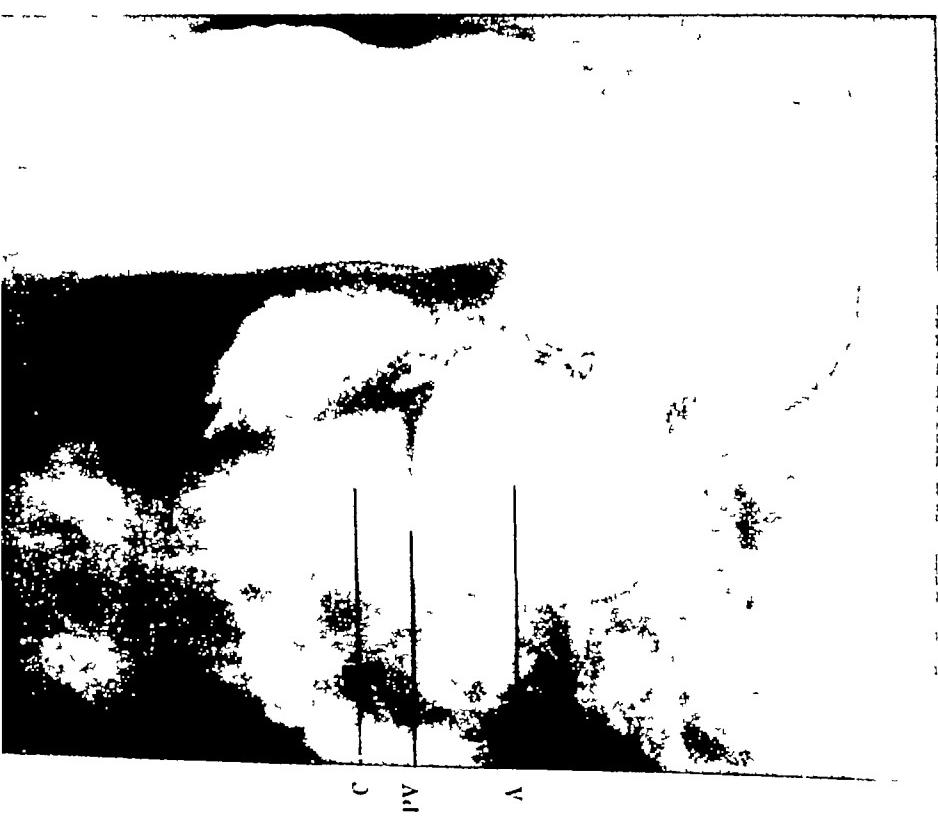


Fig. 32



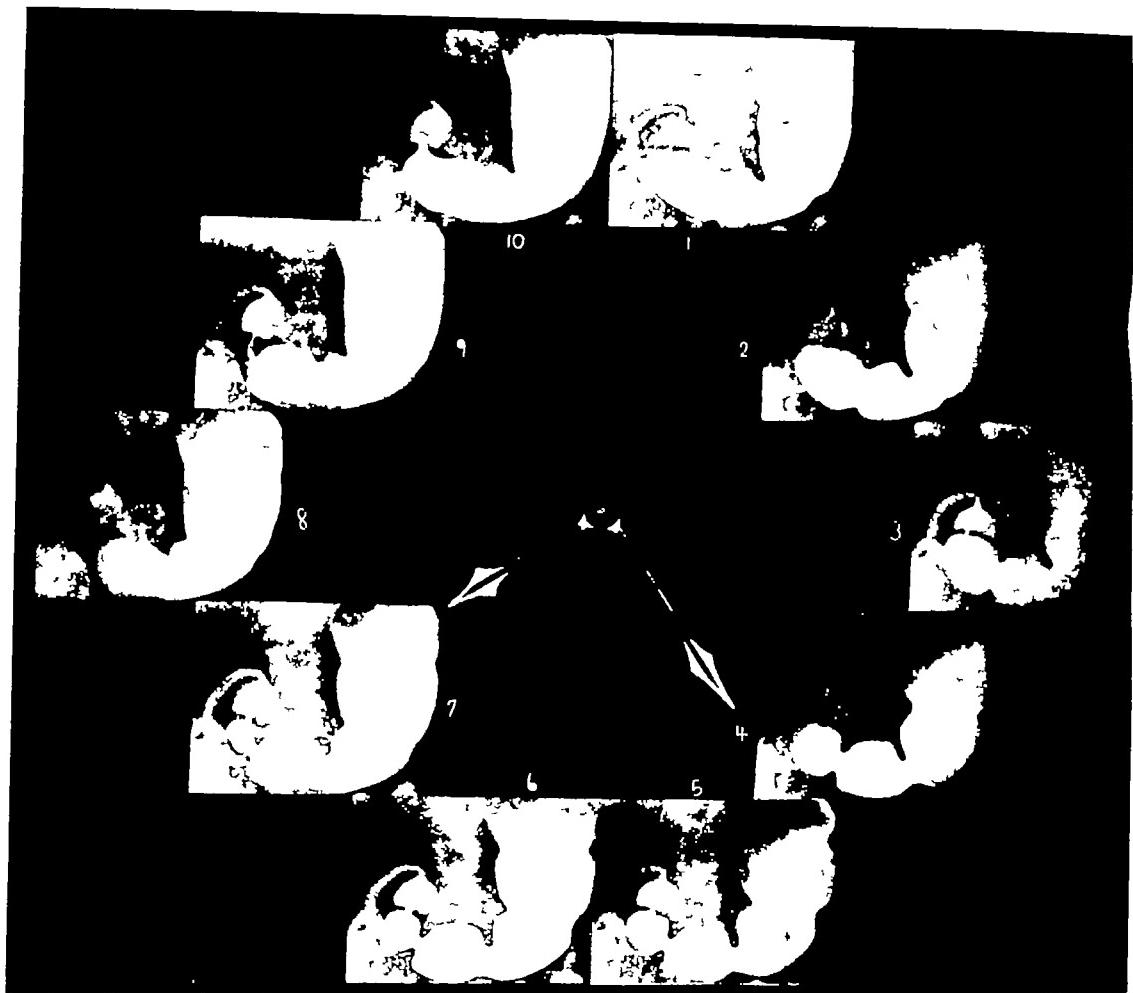


Fig. 30 Roentgenograms illustrating ten stages of a single cycle of the gastric motor phenomenon. Peristalsis is of the four-cycle type.

No 1 is the first stage of systole Nos 2, 3, 4, 5, and 6 are advancing stages of systole No 7 is the beginning of diastole Nos 8 and 9 are relaxing stages of diastole No 10 is complete diastole Nos 7, 8 and 9 show concentric contraction of the fan-shaped muscle of the pyloric canal and No 10 shows the sudden relaxation of the fan-shaped muscle.

Nos 1 to 10 show progressive filling of the cap during the gastric cycle, and Nos 7, 8 and 9 show the altered shape of the base of the cap due to the contraction of the fan-shaped muscle.

For progression of the peristaltic wave one should note both the greater and lesser curvatures

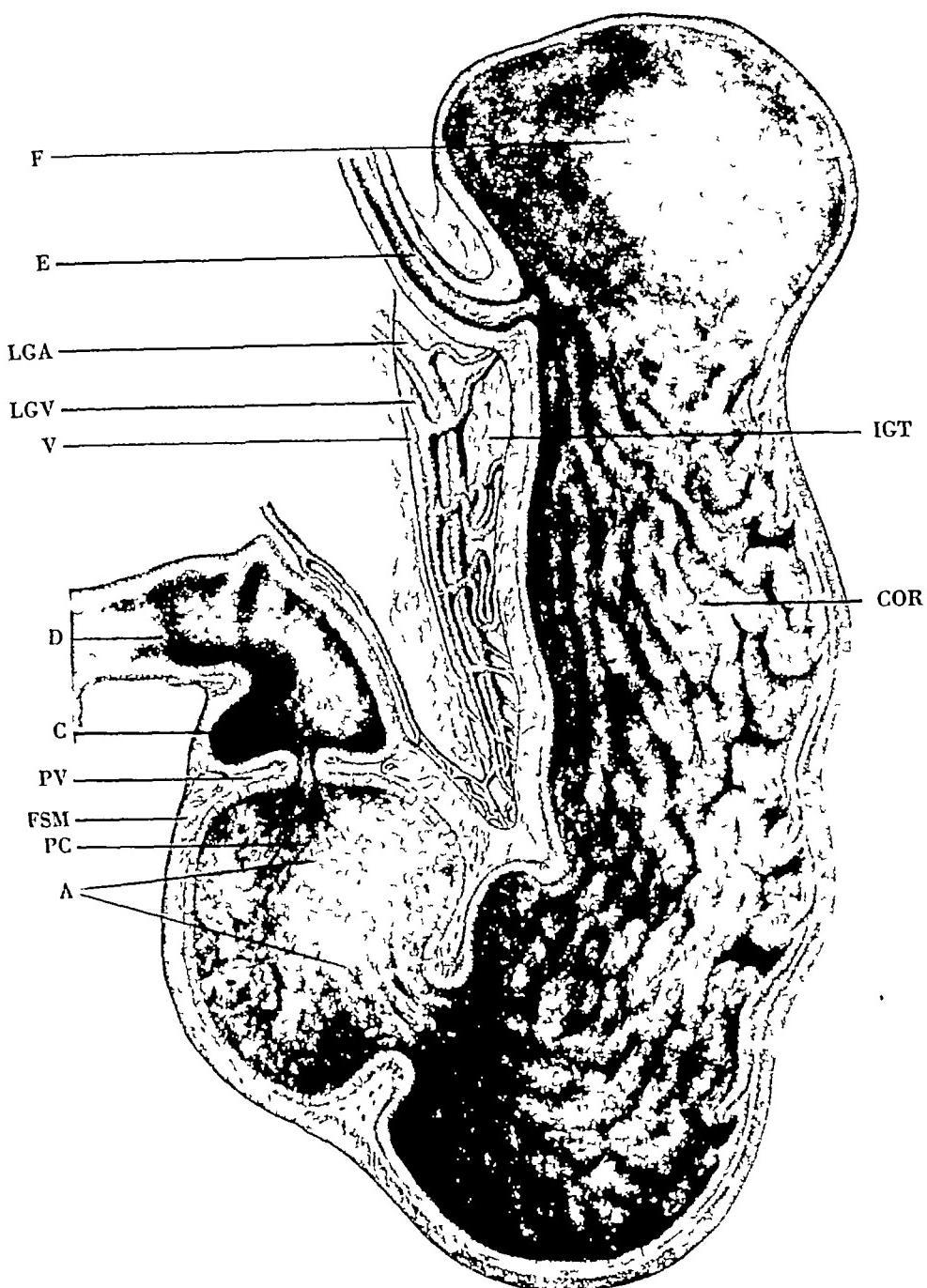


Fig 34 Drawing of inside of the stomach during diastole of the pyloric canal
 E—Esophagus *F*—Fundus *LGA*—Left gastric artery *LGV*—Left gastric vein
V—Vagus nerve *IGT*—Fat in the intraperitoneal gastric triangle *COR*—Corpus
 of stomach showing the mucosal folds or rugae *A*—Antrum *PC*—Pyloric canal,
 relaxed *FSM*—Fun-shaped muscle of the pyloric canal *PV*—Pyloric valve
C—Cap *D*—Duodenum



Fig 33 Photograph of the posterior half of a post mortem specimen which includes the lower esophagus, the stomach, the cap, and the superior duodenum. The partially distended state of the specimen was maintained by filling the specimen with a low melting point paraffin before it was preserved in formalin

E—Esophagus CO—Cardiac orifice F—Formix CR—Crinkled rugæ in the distal part of the corpus P 4—Proximal part of the antrum PC—Contracted pyloric canal FSM—Fan-shaped muscle of the pyloric canal PV—Pyloric valve C—Cap D—Superior duodenum M 4—Membrana angularis of Forssell This is a relatively thin area of the muscularis propria on the lesser curvature side of the antrum



Fig. 36. Photograph of the outside of the cap. The lumen of the specimen is filled with wax. *C*—Cap. *PC*—Pyloric canal. *X*—Junction of the cap and the pyloric canal marked by the distal edge of the contracted fan-shaped muscle of the pyloric canal. *D*—Superior duodenum. }—Wax (intervel) in the peritoneal covering of the cap.

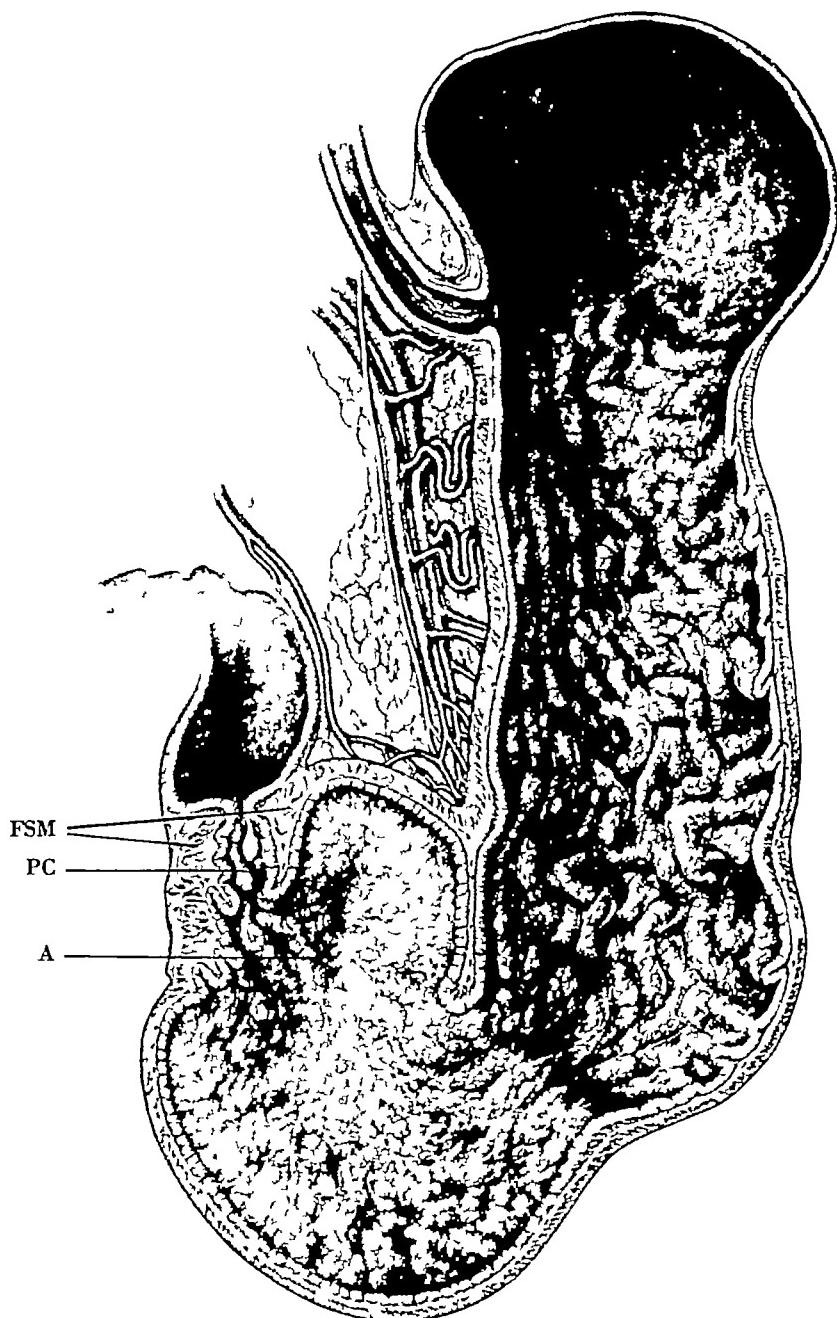


Fig. 35 Drawing of the inside of the stomach during systole of the pyloric canal. *A*—Proximal division of the antrum. *PC*—Pyloric canal contracted. The pyloric canal is the distal division of the antrum and is a functional formation due to constriction of the fan-shaped muscle (*ISV*)



FIG. 36. Photograph of the outside of the cap. The lumen of the specimen is filled with wax. *C*—Cap. *PC*—Pyloric canal. *X*—Junction of the cap and the pyloric canal marked by the distal edge of the contracted fan-shaped muscle of the pyloric canal. *D*—Superior duodenum. *Y*—A tear (artifact) in the peritoneal covering of the cap.

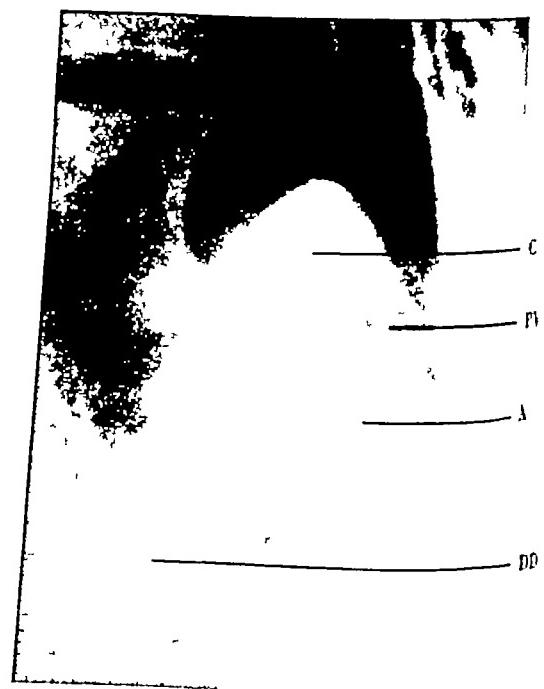
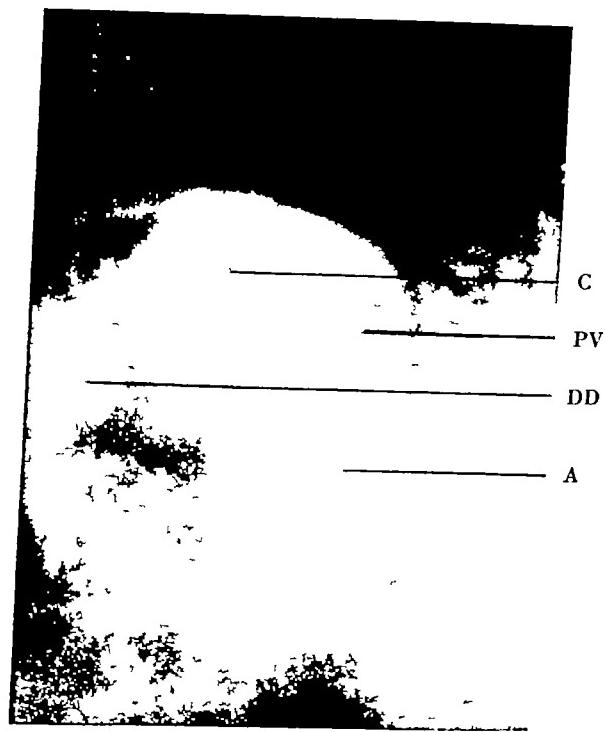
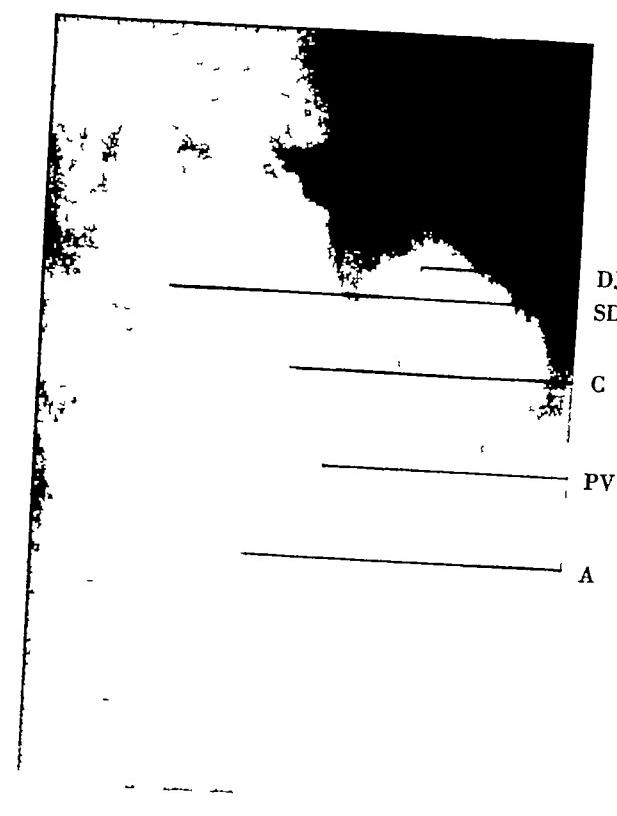


Fig. 37 Roentgenograms showing four normal caps. C—Cap PI—Pyloric valve A—Antrum DJ—Duodenojejunal flexure SD—Superior duodenum DD—Descending duodenum



Fig 38 Roentgenogram made of the gastro-intestinal tract $1\frac{1}{2}$ hours after ingestion of a barium meal. The barium meal fills all parts of the small intestine and shows also the stomach and the proximal part of the colon

S—Stomach 1—Duodenum the first coil of the small intestine 2—Second group of coils of the small intestine 3—Third group of coils 4—Fourth groups of coils 5—Fifth group of coils 6—Sixth group of coils HF—Hepatic flexure of the colon



Fig. 39 The duodenum the first of the groups of coils of the small intestine *SD*—Superior duodenum *DD*—Descending duodenum *AD*—Ascending or terminal duodenum *ID*—A portion of the duodenal flexure is concealed behind the stomach *C*—Coil *PC*—Partially contracted pyloric canal *V*—Effluent loop of the duodenocolic flexure part of the second group of coils of the small intestine *Y*—The loop of small intestine which swings back into the root of the mesentery between the second and third group of coils

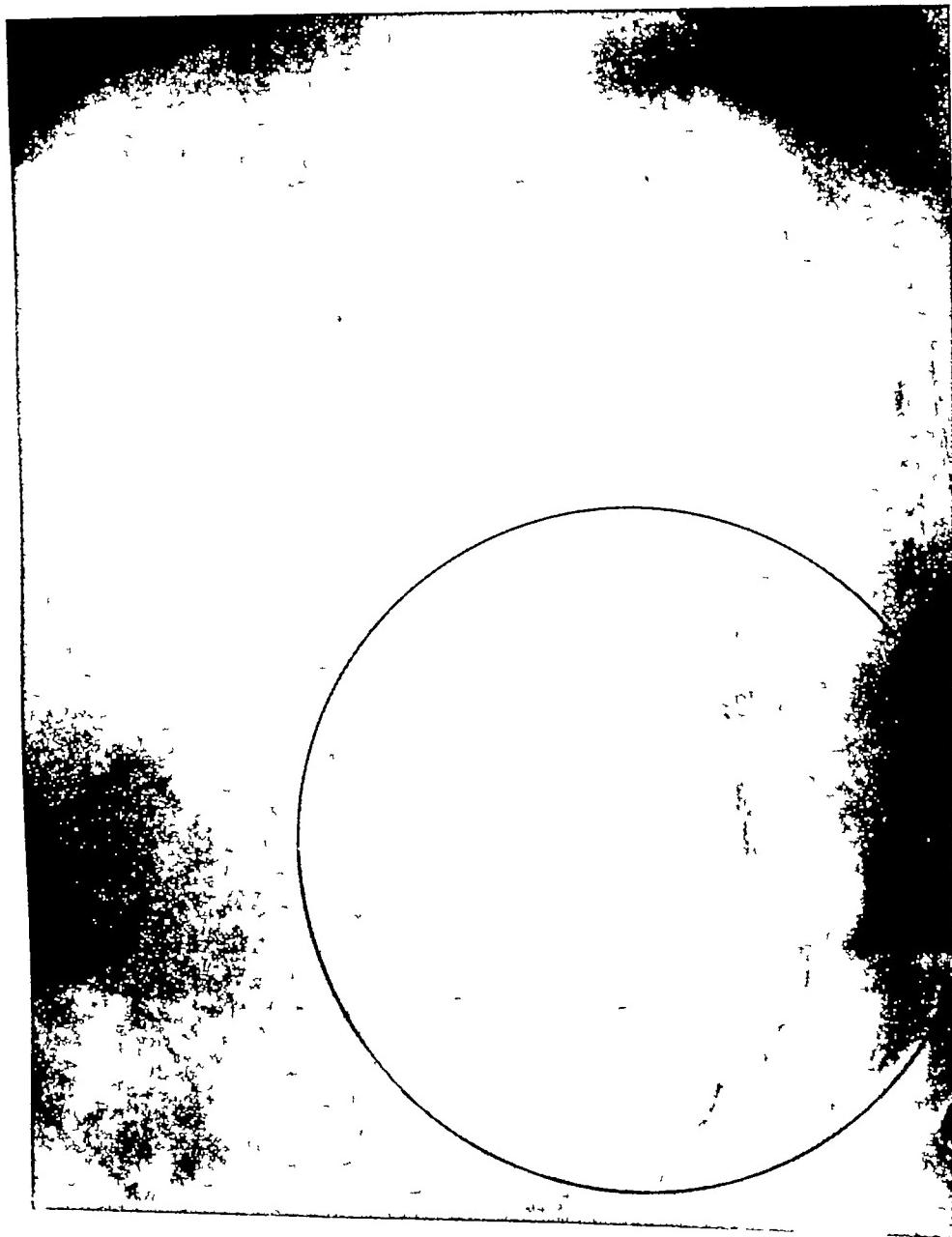


Fig 40. This figure and the following figures are a series of roentgenograms made of the same individual at varying intervals after ingestion of a barium meal. They show the progress of the meal through the small intestine, and the characteristic grouping of the coils of the small intestine.

Patient male, half-hour after the meal. The stomach is emptying at a moderately rapid and uniform rate of speed. The passage of the meal through the small intestine is keeping pace with the emptying of the stomach. All the loops of the small intestine are moderately distended. The circle is around the second group of coils of the small intestine.

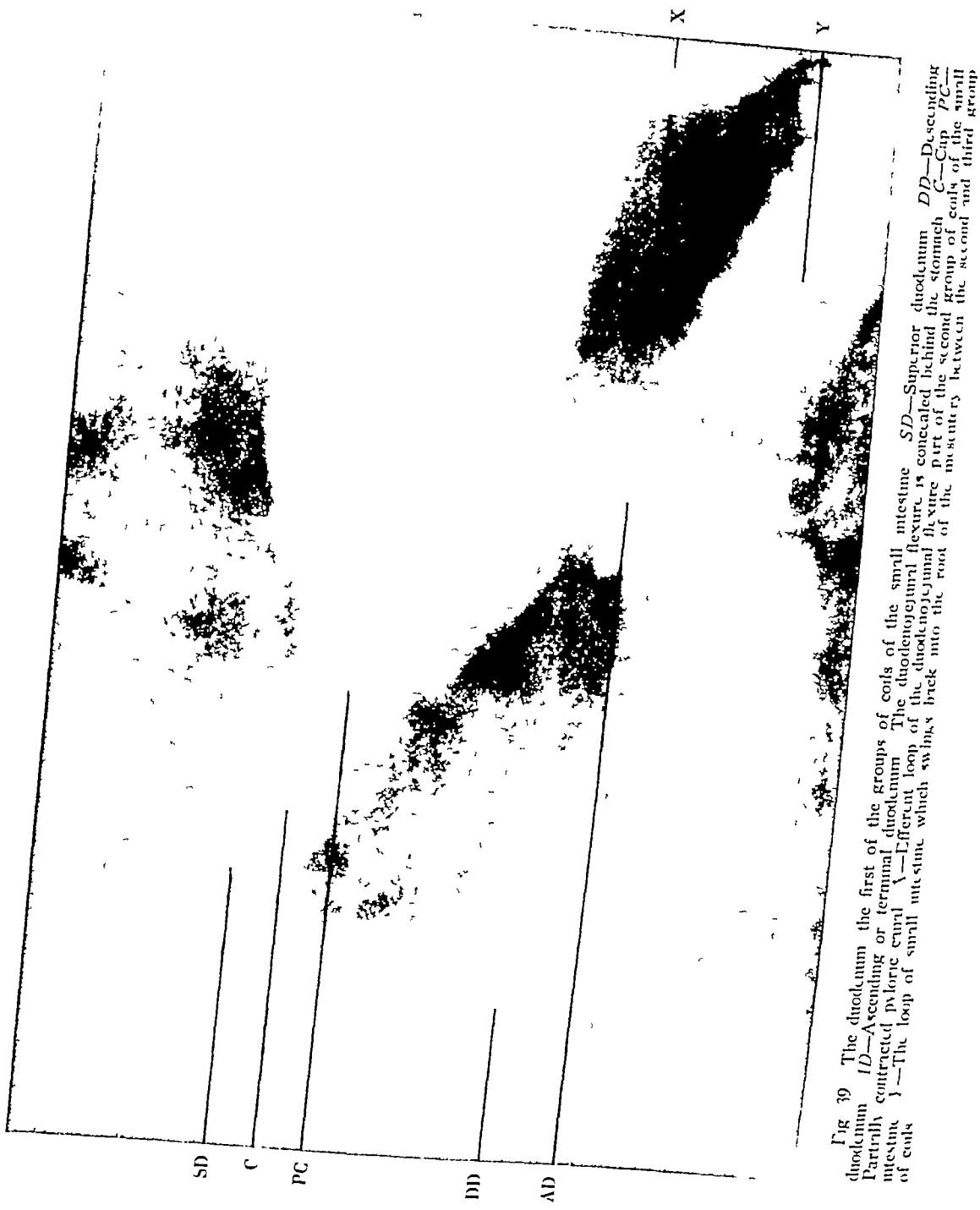


Fig. 39 The duodenum the first of the groups of coils of the small intestine *SD*—Superior duodenum *DD*—Descending duodenum *ID*—Ascending or terminal duodenum *PC*—Descending partially contracted pyloric canal *C*—Cap of the small intestine *Y*—The loop of small intestine which swings back into the root of the mesentery between the second and third group of coils *X*—The duodenocolic flexure behind the stomach *AD*—Descending part of the second group of coils of the small intestine *I*—The duodenojejunal flexure

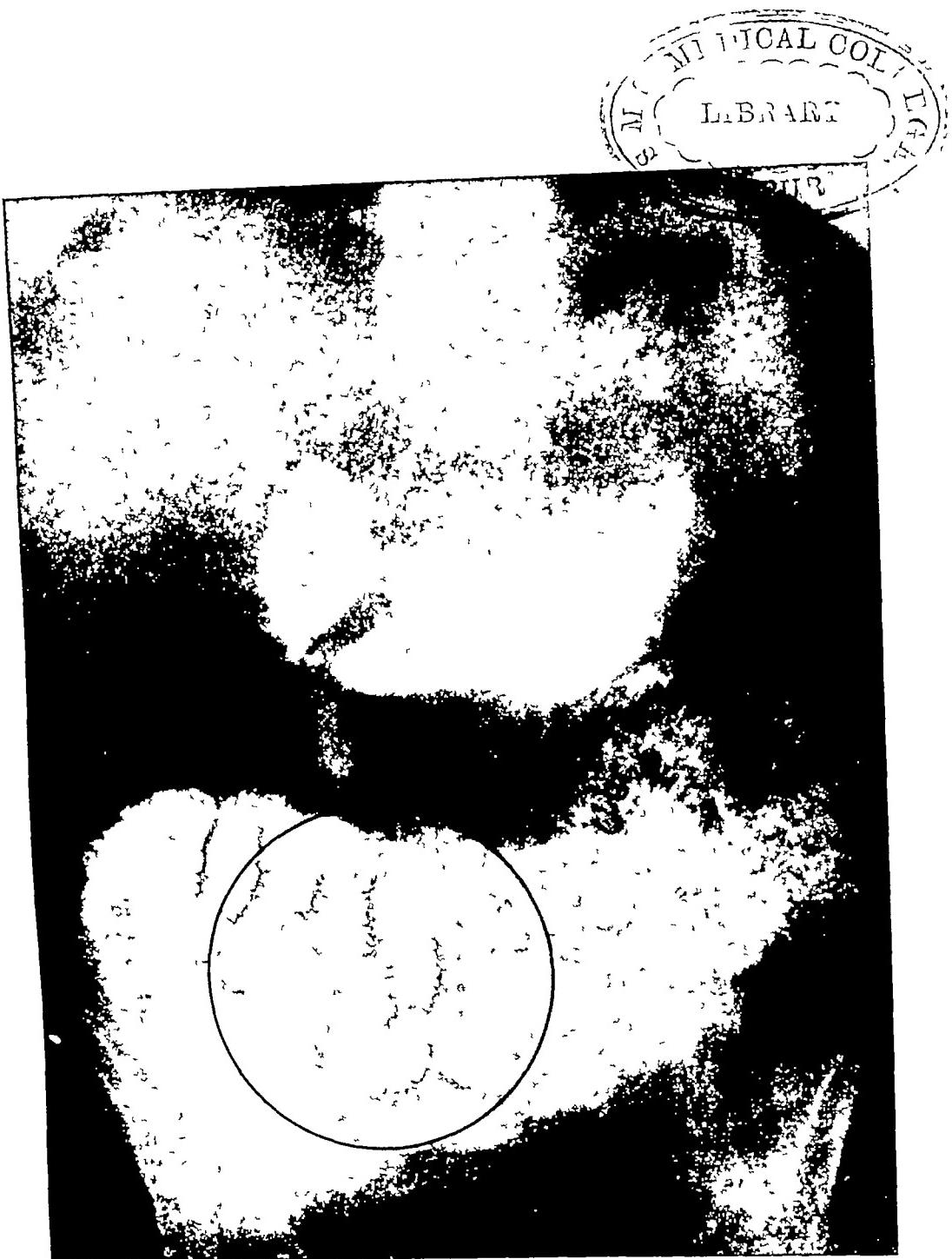


Fig 42 Same case shown in Figures 40 and 41, 2 hrs 10 min after the meal Both the fourth and fifth groups of coils of the small intestine are now filled The circle is around the fourth group of coils The fifth group of coils is to the right of the circle The right iliac and lumbar regions are the usual location of the fifth group of coils

In this figure and the following figures note the vertical arrangement of the coils within the fourth, fifth, and sixth groups of coils, and compare this with the transverse arrangement of the coils in the second and third groups



Fig. 41 Same case shown in Figure 40, one hour after the meal. The second and third group of coils of the small intestine are filled. The circle is around the third group of coils. The loops of this part of the intestine are lower in position and confined more to one region than is usually the case. For this reason the loops overlap and conceal one another. Compare with Figure 38, in which the loops of the second and third groups of coils are discretely shown.



Fig. 44 Same case shown in Figures 40-43, four hours after the meal. The stomach is empty and the head of the column is in the sixth group of coils the location of which is shown by the circle. The lower right iliac and the hypogastric regions and false pelvis are the usual location of the sixth group of coils.



Fig. 43 Same case shown in Figures 40, 41, and 42, three hours after the ingestion of the meal. Most of the barium meal in the small intestine has collected in the fifth group of coils

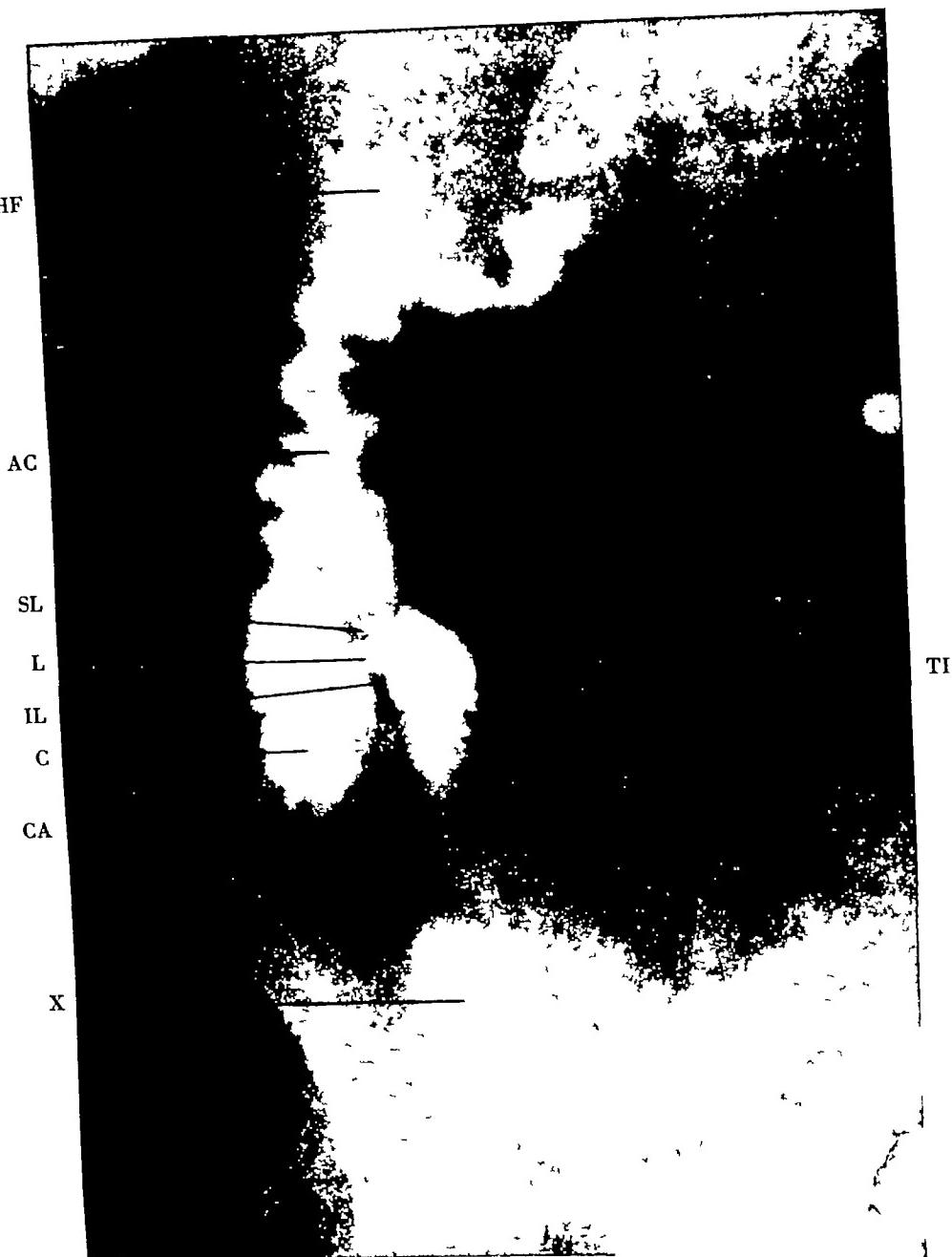


Fig 46 The ileocecal valve as shown roentgenographically immediately after the evacuation of a barium enema. The valve is open. *L*—Lumen of the valve. *SL*—Superior lip of the valve. *IL*—Inferior lip of the valve. *TI*—Terminal ileum. *C*—Cecum. *AC*—Ascending colon. *HF*—Hepatic flexure. *CA*—Area of contraction in the terminal ileum. *X*—Dilated coil of lower ileum proximal to the area of contraction.

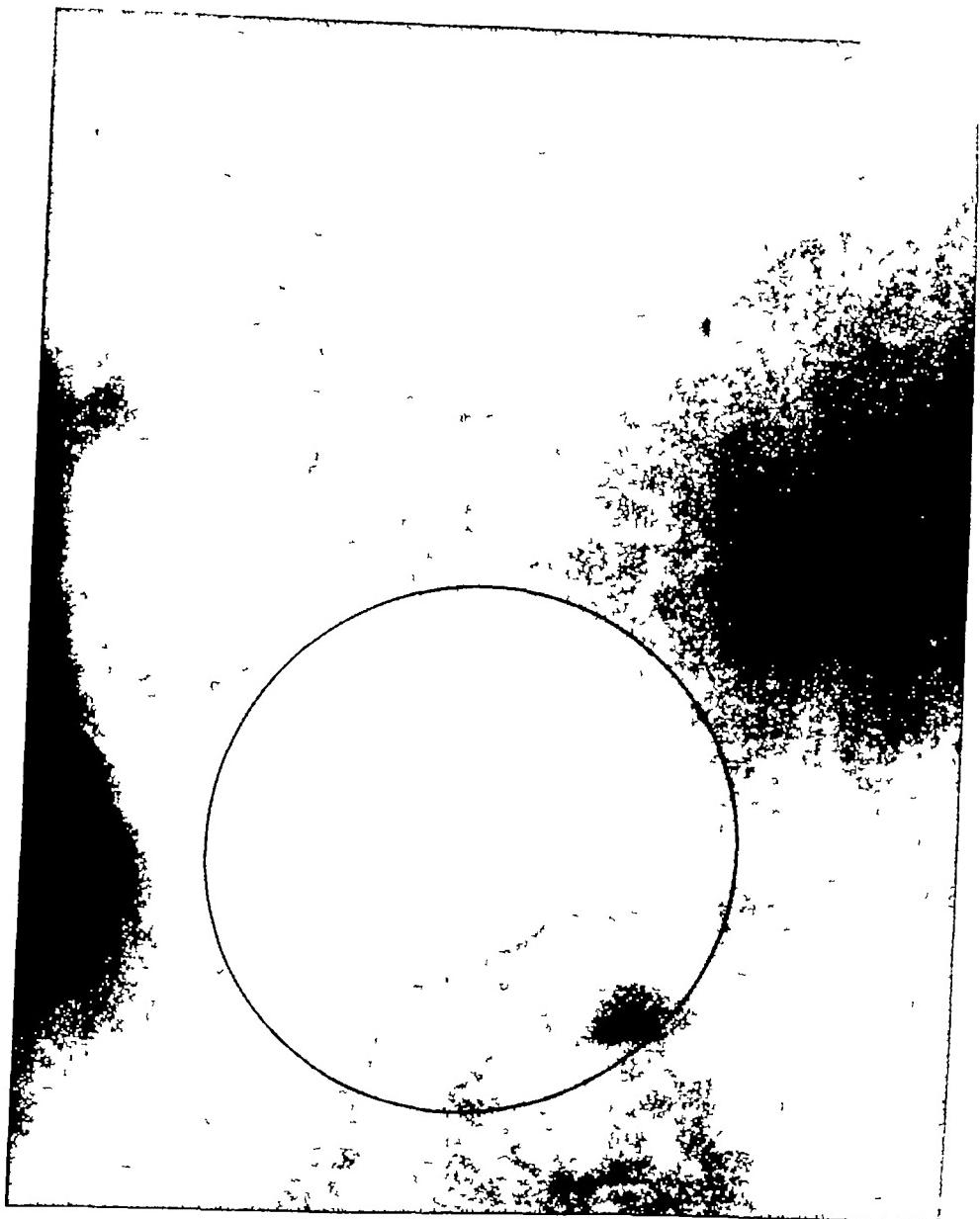


Fig. 45 Same case shown in Figures 40-44, six hours after the meal. The head of the column is at the hepatic flexure. The meal remaining in the small intestine is entirely in the sixth group of coils, as indicated by the circle

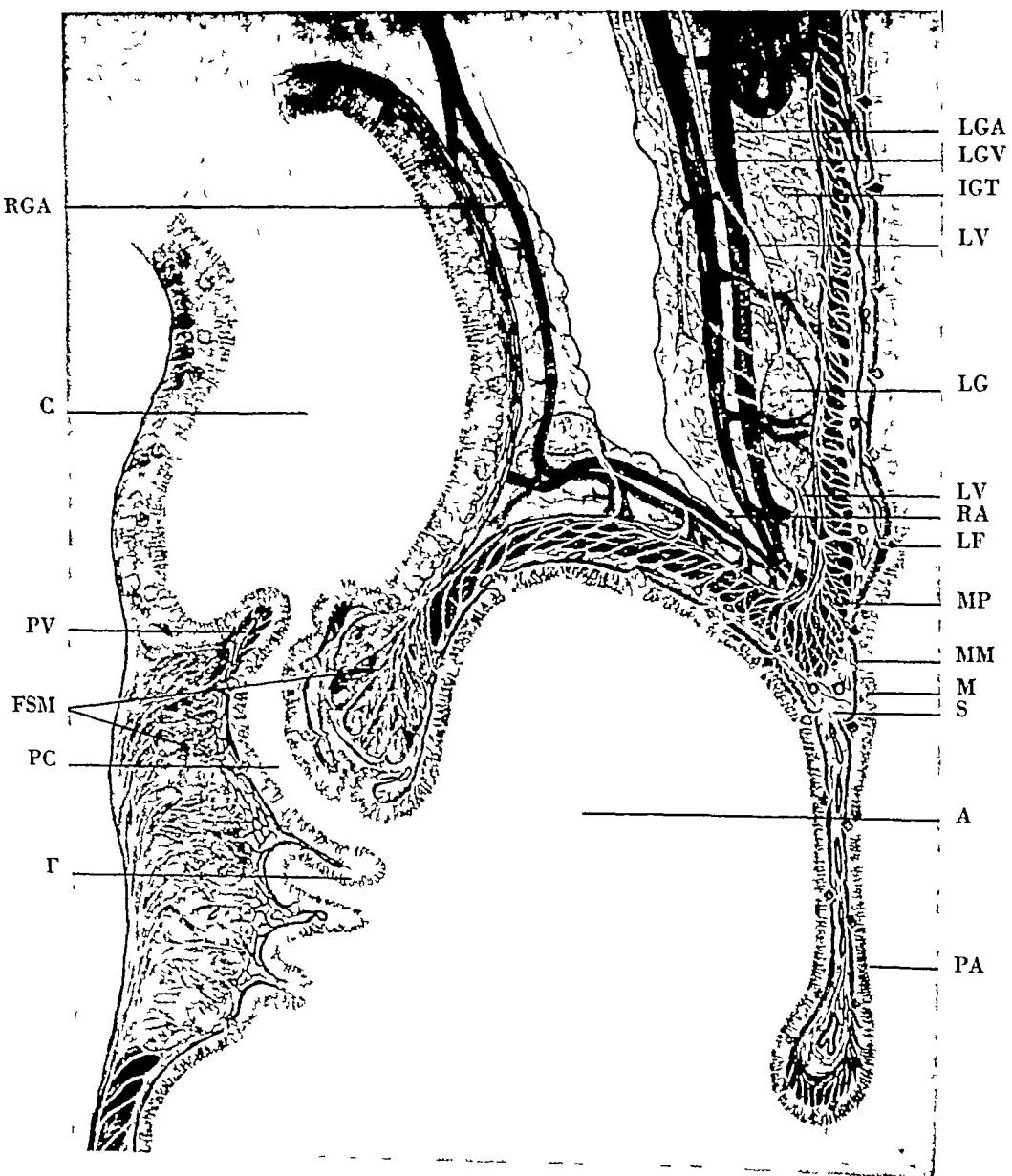


Fig. 51 Diagrammatic drawing showing the minute anatomy of the gastric wall on the lesser curvature and in the region of the pyloric canal during gastric diastole
R—Relaxed proximal division of the antrum *PC*—Contracted pyloric canal, the distal division of the antrum *C*—Cap *PV*—Pyloric valve *FSM*—Fan-shaped muscle of the pyloric canal *F*—Folds of mucosa at the proximal end of the contracted pyloric canal *Pal*—Plica angularis, the mucomembranous fold which protrudes into the lumen of the stomach and produces the sulcus angularis observed in the roentgenogram *RA*—Recedent angle or incisura angularis *M*—Mucosa *MM*—Muscularis mucosae *S*—Submucosa *MP*—Muscularis propria *LF*—Lymphoid follicle in the base of the mucosa *LV*—Lymphatic vessels *LG*—Lymphatic gland *IGT*—Fat in the intraperitoneal gastric triangle *LG 4*—Left gastric artery *LGI*—Left gastric vein *RGA*—Right gastric artery

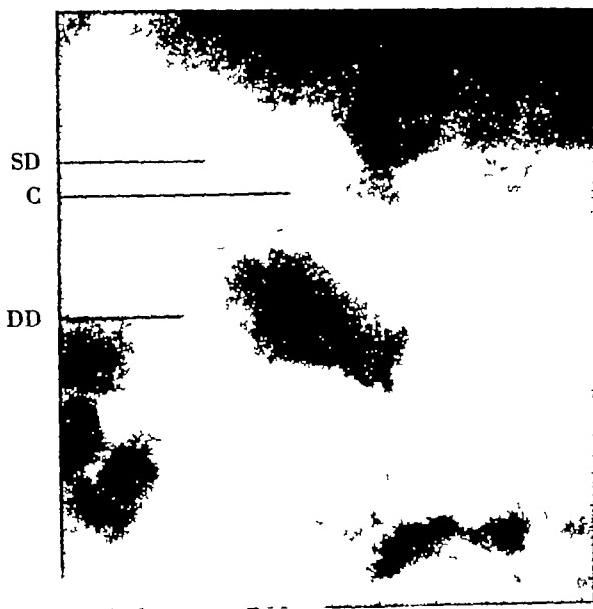


Fig. 47. Roentgenogram made in the postero-anterior direction which shows how superimposition of a long superior duodenum (*SD*) over the cap (*C*) may simulate the appearance of a deformed cap due to ulcer *DD*—Descending duodenum

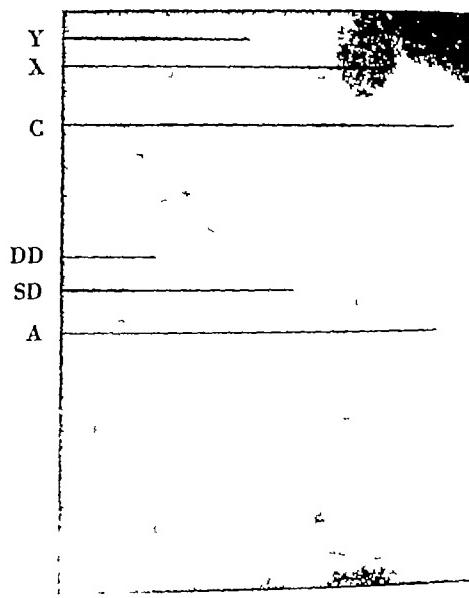


Fig. 48. Roentgenogram made in the oblique projection which shows an unusually long superior duodenum (*SD*), which forms a loop and hangs inferiorly from the two points of suspension *X* and *Y*. *C*—Cap *A*—Antrum of stomach *DD*—Descending duodenum

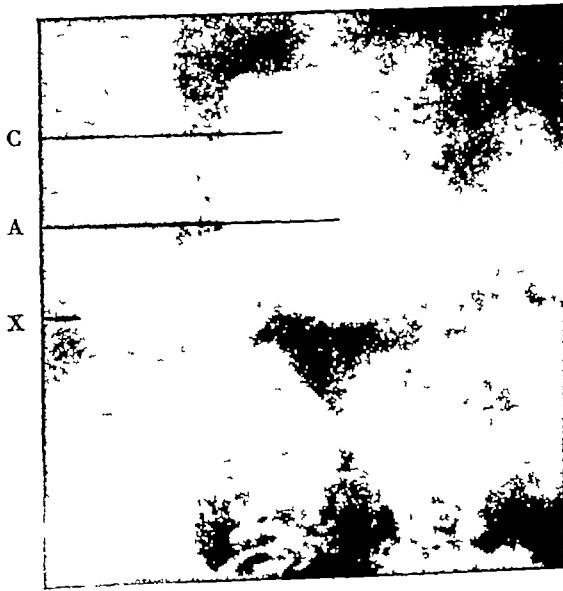


Fig. 49

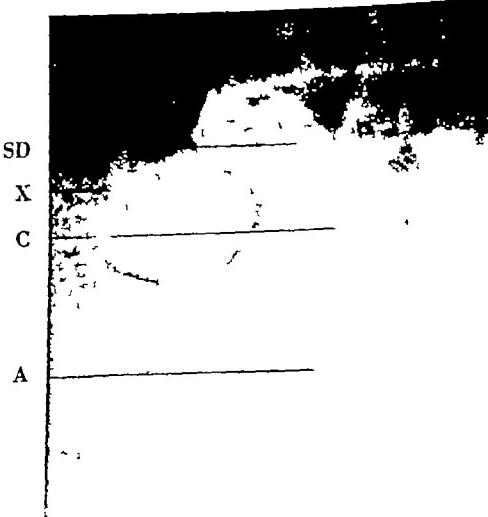


Fig. 50

Figs 49 and 50 are postero-anterior roentgenograms of the same individual, Fig. 49 being made in the postural position and Fig. 50 in the erect posture. At *X* there is an abnormal fixation and angulation of the descending duodenum at the site of crossing of the transverse mesocolon. In the erect posture, Fig. 50 the barium remains in a short loop above this abnormal point of fixation and simulates the appearance of a diverticulum of the descending duodenum. *C*—Cap *A*—Antrum of the stomach *SD*—Superior duodenum

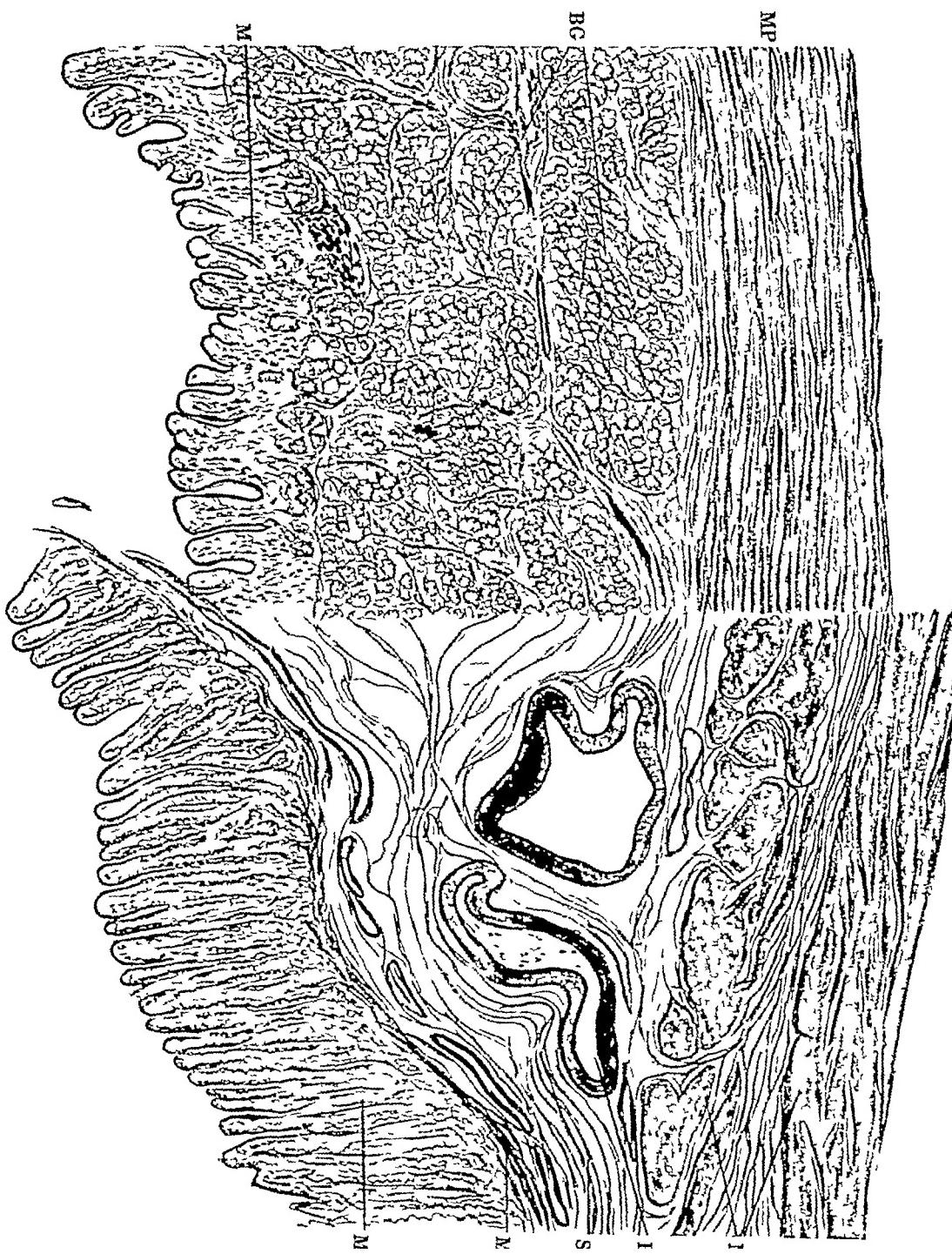


FIG. 53 Diagrammatic drawing in color, comparing the structure of the wall of the stomach and the wall of the cap
M—Mucosa S—Submucosa MM—Muscularis mucosae MP—Muscularis propria BG—Brunner's glands BV—Blood vessels

Cap

Stomach

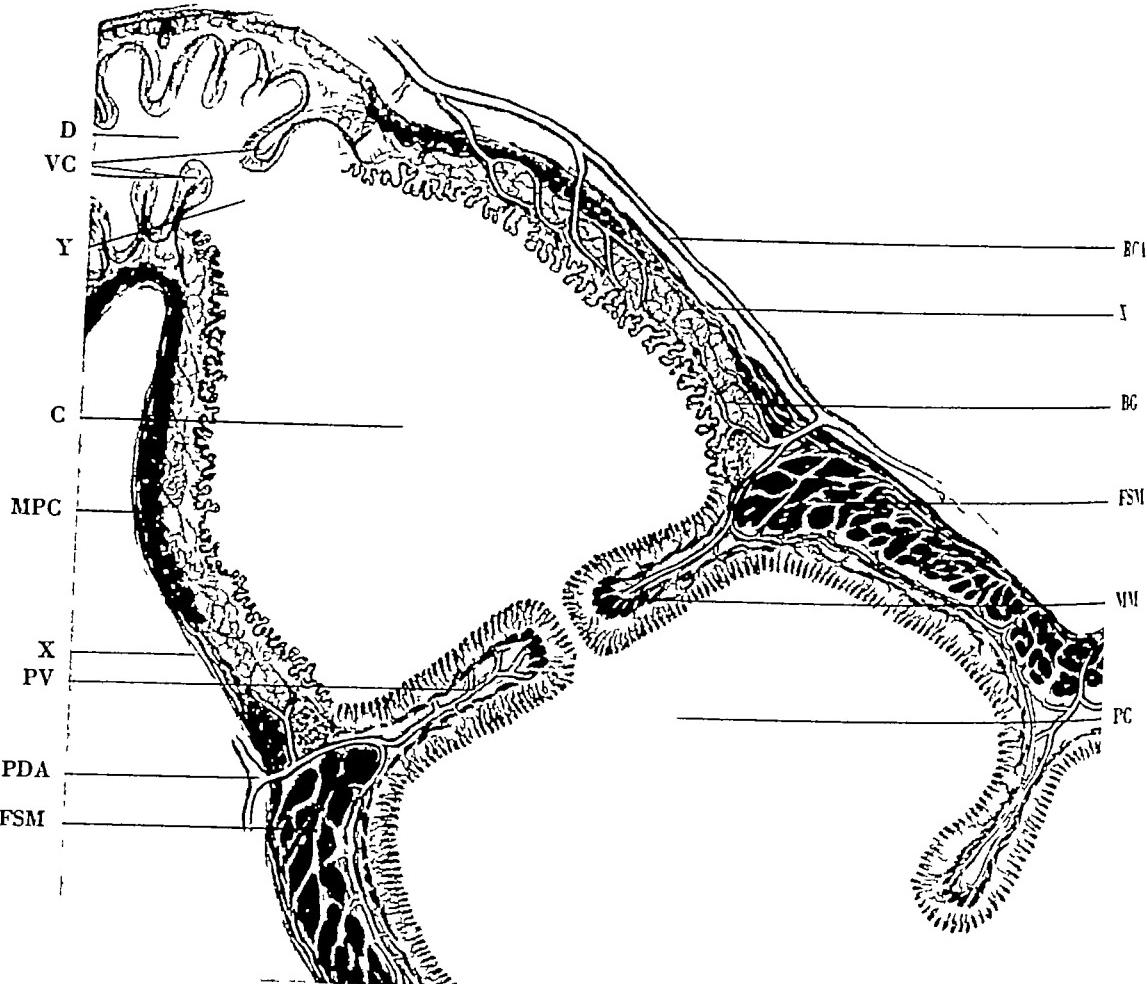


Fig 52 Schematic drawing of the wall of the antrum and of the cap with the pyloric canal relaxed and the pyloric valve closed. *PC*—Relaxed pyloric canal or distal part of the antrum. *C*—Cap. *PV*—Pyloric valve. *D*—Duodenum. *FSM*—Fan-shaped muscle of the pyloric canal. *MM*—Contracted muscularis mucosae in the pyloric valve. The muscularis mucosae closes the valve and there is no pyloric sphincter of the muscularis propria of the stomach. *BG*—Brunner's glands of the cap. *MPC*—Muscularis propria of the cap. This is much thinner than the muscularis propria of the stomach. *X*—Area in the wall of the cap in which the muscularis propria is deficient. This is also the area in which the arteries terminate as end arteries. *VC*—Valvulae conniventes the folds characteristic of the small intestine. *Y*—Junction of the cap and the descending duodenum. *RGA*—Right gastric artery. *PDA*—Branches of the pancreatico-duodenal artery.

Cap



Fig. 53
Diagrammatic drawing in color, comparing the structure of the wall of the stomach and the wall of the cap
M—Mucosa *S*—Submucosa *MM*—Muscularis mucose *MP*—Muscularis propria *BG*—Brunner's glands *BV*—Blood vessels



Fig. 54



Fig. 55



Fig. 56



Fig. 57

Figs 54, 55, 56 and 57, inclusive, illustrate our routine roentgenographic examination of the colon. In the postero-anterior projection (Fig 54) there is superimposition of regions of the colon at and near both the hepatic and splenic flexures. A lesion of the colon may be concealed in either of these regions. This superimposition of the colon is obviated by making roentgenograms in the right oblique projection (Fig 56), and in the left oblique projection (Fig 57).

The right oblique projection (Fig 56) shows the posterior curve of the ascending colon as it conforms to the curvature of the posterior abdominal wall, and also the sharp curve of the colon at the hepatic flexure.

Fig. 55, the roentgenogram made of the colon immediately after evacuation of the barium enema, shows the colon in the contracted state and the folds of the mucosa.

Fig 58 Colon filled with barium enema



Fig 59 Colon after evacuation of the barium enema



Figs 58 and 59 are roentgenograms made of the same patient, Fig 58 being made when the colon was moderately distended with the barium enema and Fig 59 being made after evacuation of the barium enema. A comparison of these roentgenograms shows the marked diminution in length of the colon which takes place when it is considerably reduced in size and when the stool is evacuated. It is also seen that the sigmoid colon is more easily reduced than the transverse colon.



Fig. 60 Photograph of one-half of a specimen of the colon, cut longitudinally. This specimen was removed by surgical resection and was preserved immediately after removal, the specimen being hardened around a wax cast so that its natural form was retained. *M*—Mucosa *S*—Submucosa *MP*—Muscularis propria *LM*—Longitudinal muscle coat of the muscularis propria *CM*—Circular muscle coat of the muscularis propria *AE*—Appendix epiploica

In this specimen one can observe unusually clearly the structure of the semilunar folds (*F*) which protrude into the lumen of the colon, divide the lumen into sacculations or hastrations, and give to the colon its characteristic appearance. Several of these folds are shown in this specimen and each of these folds is composed of a reduplication of the mucosa and muscularis mucosae and a core of submucosa. The circular layer of muscle of the muscularis propria does not enter into the formation of these folds with the possible exception of the indrawn muscularis propria at $\frac{1}{4}$. It is our conviction from roentgenographic studies of the colon and from a study of specimens of the colon prepared as was this specimen, that the folds which form the hastrations of the colon are due to contraction of the muscularis mucosae and are not due to contraction of the muscularis propria, and are not a passive formation due to contraction of the longitudinal bands.

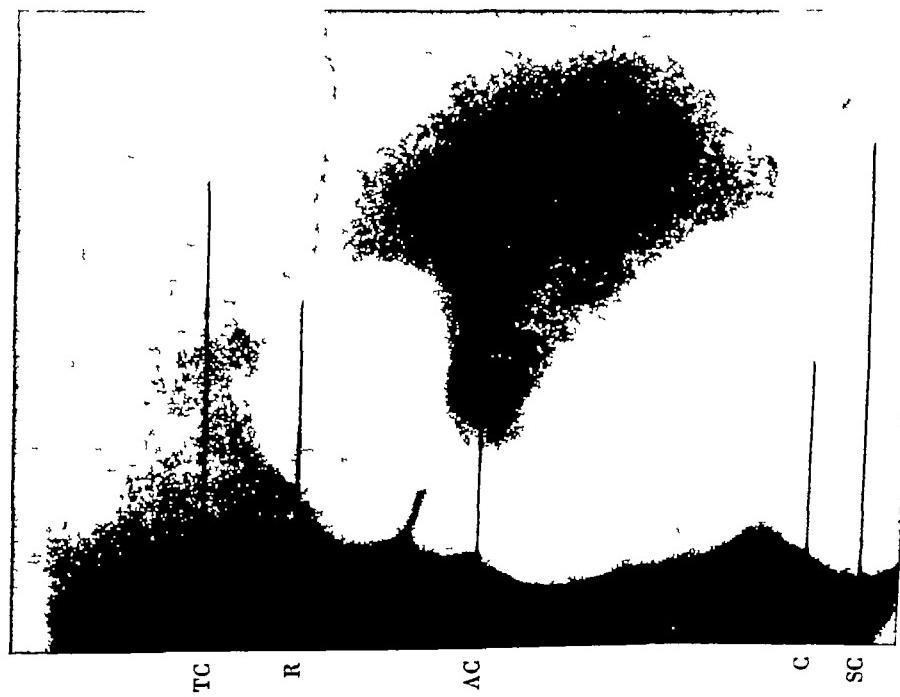


Fig. 61 Ring of tonic contraction (*R*) in the proximal part of the transverse colon (*TC*). The cecum (*C*) and the sigmoid colon (*SC*) are filled with a mixture of the barium enema and fecal material and the density of the shadow is considerably less than that of the barium enema in the transverse colon and the sigmoid colon (*SC*).

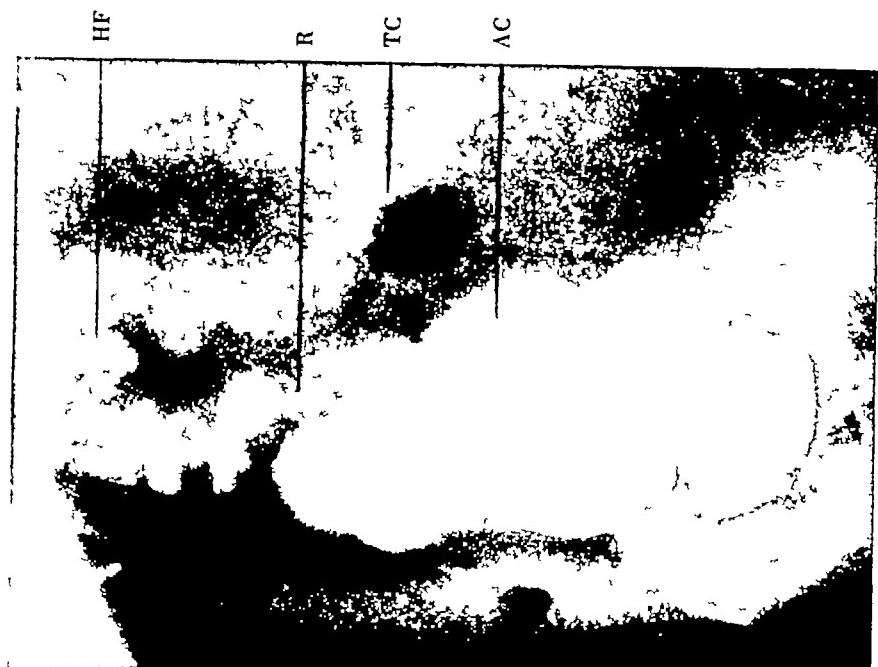


Fig. 62 Roentgenogram made after evacuation of a barium enema which shows a ring of tonic contraction (*R*) in the middle of the ascending colon (*AC*). Proximal to the area of constriction the colon is reflexed and moderately distended. The ring of contraction is at the proximal end of a general contraction of evacuation involving the upper part of the ascending colon (*AC*) and the rectum (*HF* and *SC*).



Fig. 63 Four roentgenograms made of the same individual during an examination of the colon, which show a constant ring of tonic contraction between the cecum and ascending colon. This was apparently a hyperactive pacemaker which was the source of a persistent diarrhea that developed on the least excitation or worry. In spite of the constancy of this annular ring of contraction the presence of normal mucosal folds within the area of contraction demonstrates that it is not due to an organic lesion and enables one to make a negative diagnosis of cancer.

FIG. 1418

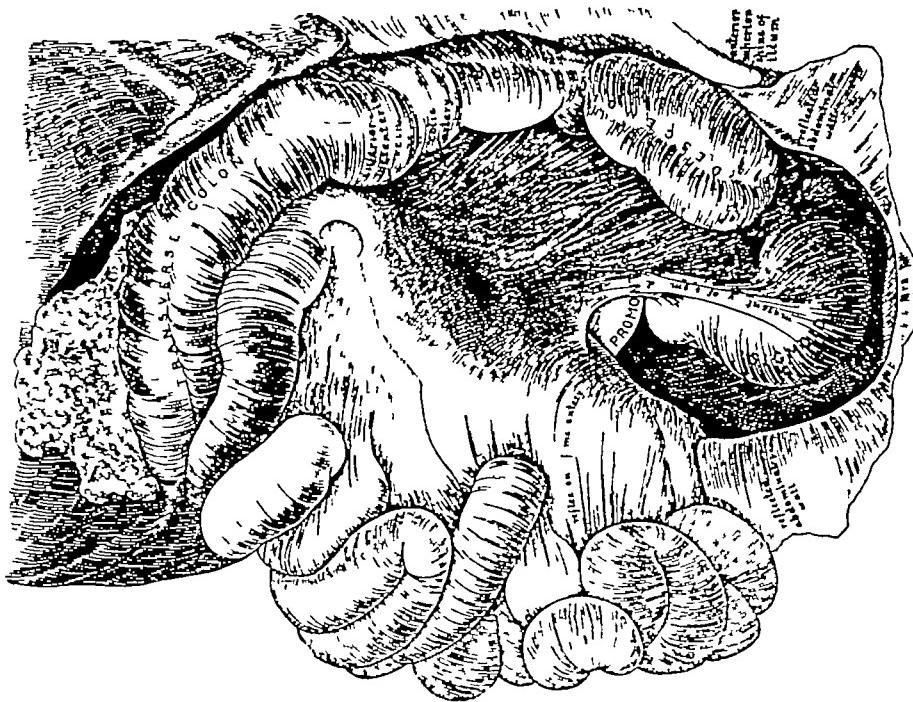


Fig. 64 Reproduction of an anatomical drawing from Qurin's text book on anatomy. Left side of abdomen, small intestine turned to right, exposing mesentery, mesocolon of descending colon and mesosigmoid. At the junction of the descending and sigmoid colon is labelled in the drawing, the colon is covered with a relatively narrow band of peritoneum. The rectum is shown in its anatomical position in Figure 65.

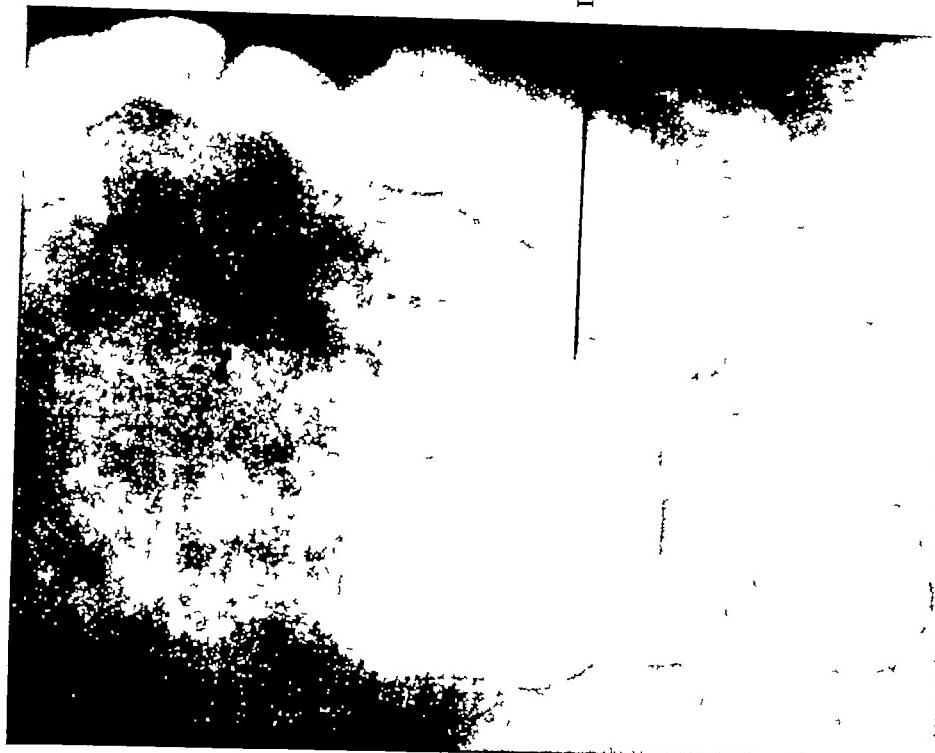


Fig. 65 Roentgenogram showing the descending and sigmoid colon moderately distended with a barium enema. At PB there is fixation of the colon by a band of peritoneum which does not allow the colon to expand as much as the edacent parts of the colon. The anatomical basis for this finding is illustrated in Figure 64.

THE CAPACITY OF X-RAY TUBES AS INFLUENCED BY THE GEOMETRIC DESIGN OF THE FOCAL SPOT, INCLUDING THE ADVANTAGES AND LIMITATIONS OF THE LINE FOCUS PRINCIPLE

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IT MAY be fairly stated that the capacity of modern X-ray installations is limited only by the ability of the X-ray tube to utilize energy without prohibitive damage. The capacity of the X-ray tube is, in turn, limited largely by its ability to dissipate heat.

The heat-dissipating function of a tube is, however, of two distinct orders. One of these is concerned with the ultimate removal of heat from the anode, as by radiation and conduction. The other is invoked only when much energy is applied in a time interval which is short in terms of the time necessary for conduction of heat by the metal. Under these latter conditions, the tungsten on the immediate surface of the focal spot may be melted while the body of the anode is cold.

Exclusive of the use of a metal having higher specific heat, greater heat conductivity, or higher melting point, we know of only two ways by which the heat capacity of a focal spot may be influenced under large loads of split second duration¹. The first of these is to start the exposure with a cold anode, and, if frequent exposures are necessary, water cooling is a boon to the radiologist for this purpose. The second method is to have the area of the focal spot as large as possible and thus to reduce the load per unit area to a minimum. As a corollary to this, it should be noted that uneven cathode-ray distribution diminishes the effective area of the focal spot by leaving spaces with sub-

average radiation, while overloading adjacent parts.

The ability of a focal spot to utilize energy without damage is, however, meaningless in radiography unless correlated with the degrees of fineness of focus, otherwise we would use therapy tubes for radiography. The area of the focal spot is thus limited by the size of focus we are willing to employ under the conditions in use. Given this limit of size of focus, it is incumbent on the manufacturer to design into the tube the maximum possible focal spot area. This he may do by management of the geometric characters of the focal spot.

The efficiency of an X-ray tube under high-energy, short-exposure conditions, may then be expressed as the ratio of capacity to fineness of focus.² This in turn resolves itself into the ratio of the area of the focal spot to the effective size of the focus under the conditions in use.

It is the purpose of this paper to show the changes that occur in the area of the focal spot, and, consequently, in tube capacity, under varying conditions of focal spot design.

BASIS FOR CAPACITY DETERMINATIONS

Before proceeding to an analysis of varying geometric design, upon the area and consequent capacity of the focal spot, we must first review what is meant by "effective fo-

¹This presupposes that the amount of X radiation reaching the film is constant for any slope of anode. There are apparently, however, no final physical data as to the relation of X-ray intensity in different directions, to the angle at which the cathode stream impinges on the focal spot. In practice, however, we have not observed any reduction of radiation over the film with line focus tubes compared with 45° anodes, providing the tube is placed at the proper distance from the film as shown later in this article.

²The rotating anode constitutes a further principle by which surface capacity may be increased by moving cold metal into the field during the exposure.

FIG 1418

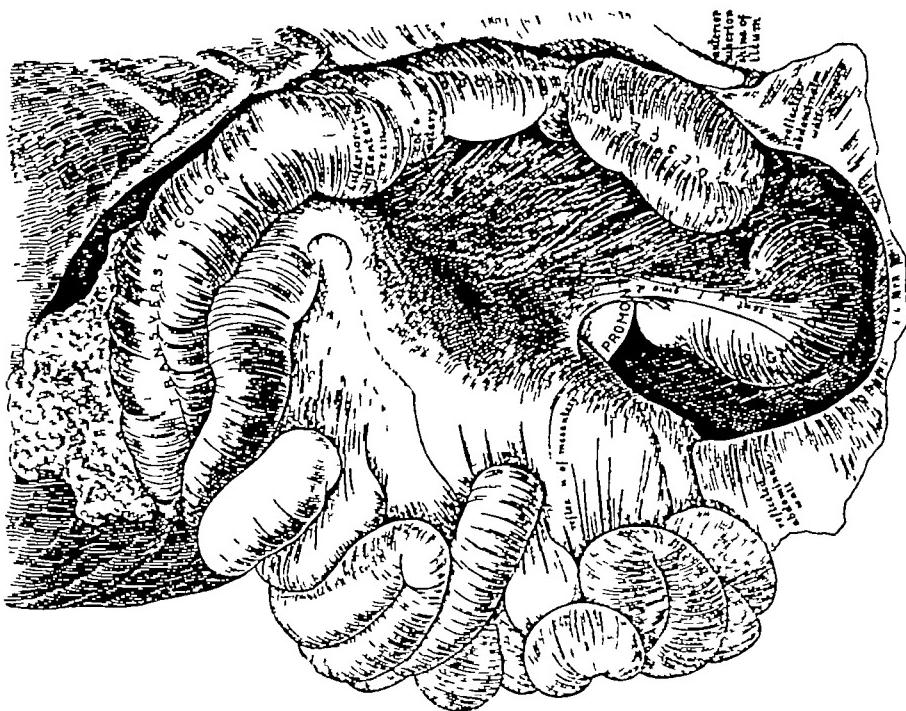


Fig. 64 Reproduction of an unanatomical drawing from Quran's text book on anatomy. Left side of abdomen small intestine turned to right, exposing mesenter, mesocolon of descending colon and mesosigmoid. At the junction of the descending and sigmoid colon is labelled in the drawing, the colon is covered with a relatively narrow band of peritoneum. The roentgenographic findings of this intramural formation are illustrated in Figure 65

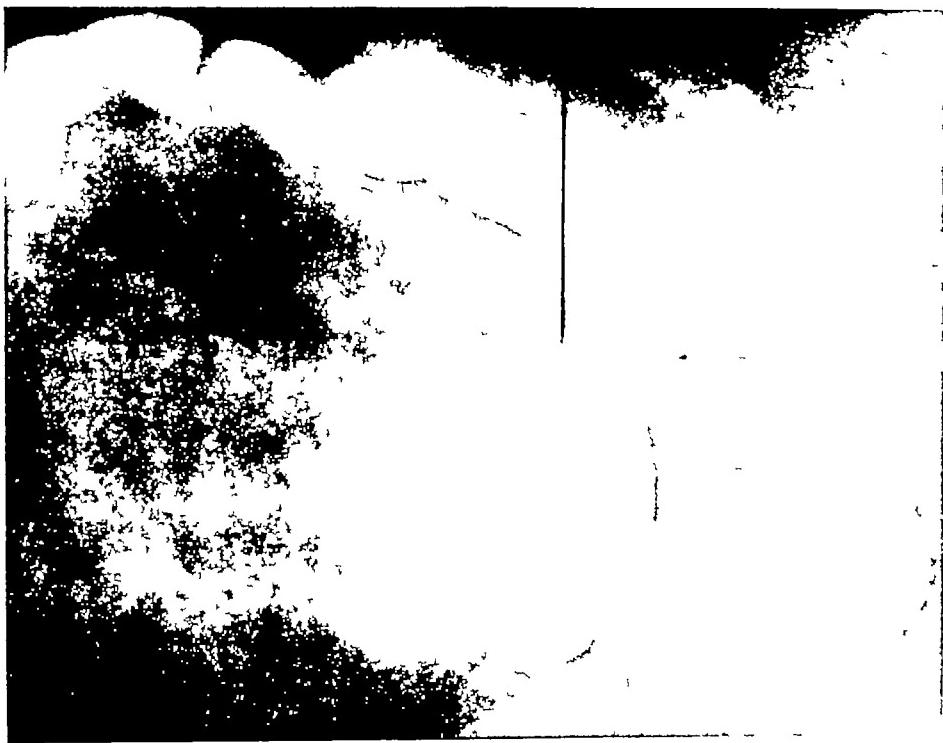


Fig. 65 Roentgenogram showing the descending and sigmoid colon moderately distended with a barium enema. At PB there is fixation of the colon by a band of peritoneum which does not allow the colon to expand as much as the adjacent parts of the colon. The roentgenographic basis for this finding is illustrated in Figure 64

minor axes of the projection figure is a perfectly satisfactory approximation of the value of the focus at a point [for elliptic focal spots] it is shown in the foregoing communication that this value is more correctly expressed by the average distance between all parallel tangents to the projection figure Since the present study is a theoretic consideration of the efficiency of varying focal spot designs, this latter figure has been used in the derivation of efficiency data)

Technical Methods—The determination of the focal spot area associated with any size or shape of projection figure is, of course, a matter of projective geometry

The determination of the average distance between parallel tangents to any projection figure was made by taking the average distance between parallel tangents at five-degree intervals around the figure Although this may be done mathematically to incorporate all parallel tangents, the methods are too involved to be applicable to this problem In the case of elliptic projection figures (*i.e.*, cast by an elliptical focal spot) the determinations were mathematical In the case of projection figures other than a true ellipse, purely mathematical determinations are, again, impracticable or impossible For these conditions the projection figures were drawn to large scale on co-ordinate paper, and the tangents drawn at five-degree intervals and measured Areas were computed by the method of counting squares

The values given in the tabulations are in each case that area of focal spot which projects unit focus at the cathode end of the film The actual focus is converted to unity by the formula $\frac{\text{Area of Focal Spot}}{(\text{Effective Focus})^2}$ In this way the areas of different designs of focal spot are made directly comparable

The Geometric Shape of the Focal Spot—This resolves itself into an analysis of the relative efficiency of elliptic focal spots *versus* figures of different geometric shape,

but with the major and minor axes of the same size as those of the elliptic focal spots

Such figures are shown in Diagram II in a circumscribed rectangle The larger

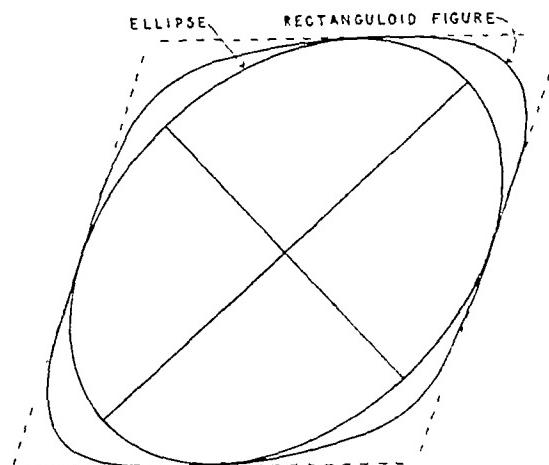


Diagram III. Elliptical and rectanguloid projection figures at cathode corner of film

figure has the shape of the focal spot commonly seen in "line focus" tubes The diagonal of this figure is 83 per cent, and the area is 92 per cent of that of the circumscribed rectangle The area of an ellipse is 78.54 per cent of that of the circumscribed parallelogram The efficiency of this rectanguloid focal spot, as we shall call it, compared with an elliptic focal spot, depends upon which of these geometric shapes has the larger area when both project unit size of focus at the cathode end of the film

TABLE I—AREA OF FOCAL SPOT FOR UNIT FOCUS

| Film Position | Ellipse | Rectanguloid Figure | Gain by Ellipse |
|------------------|---------|---------------------|-----------------|
| Film center | 1.111 | 1.056 | 5.20 per cent |
| Mid-cathode end | 0.804 | 0.770 | 4.42 per cent |
| Mid-anode end | 1.610 | 1.522 | 5.78 per cent |
| Cathode corner | 0.864 | 0.754 | 14.59 per cent |
| Anode corner | 1.590 | 1.487 | 6.92 per cent |
| Mid-lateral edge | 1.055 | 1.040 | 1.44 per cent |

Mean gain in area by ellipse... 6.39 per cent

Table I shows the area of focal spots, both elliptical and rectanguloid, which project unit focus at various points on a

cus" Focal spot projection, or "focus," is illustrated in Diagram I, and consists of the parallel line projection of the focal spot upon the film An object at any point on a film

the projection figure may be circular, sharpness of shadow will vary in different directions at any given point, corresponding to the varying diameters of the projection fig-

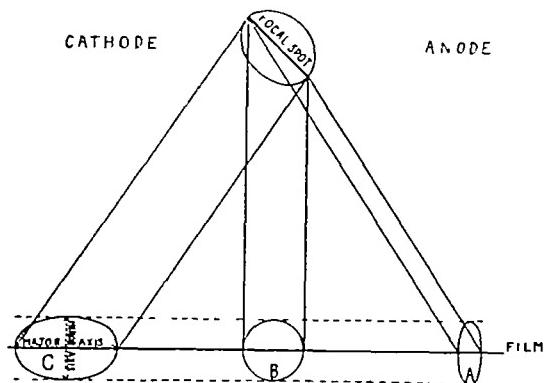


Diagram I Focal spot projection in long axis of tube.

(as at A, B, or C) is, in effect, radiographed with a focal spot of the size and shape of this focal spot projection, and not with the characters of the focal spot itself The "focus" is thus the measure of potential sharpness and radiability on the film as far as the tube itself is concerned Actual sharpness and radiability, of course, depend also on other factors, the chief of which are the ratio of the object-film to the target-object distance, and the excellence of photographic reproduction

It will be seen that the focal spot projection is quite different at different points on the film Identical objects radiographed at the points A, B, and C will consequently cast shadows of quite different characteristics Sharpness of shadow will depend on, *i.e.*, be inversely proportional to, the diameter of the projection figure in any direction, and there will be a varying degree of distortion in the shape of the image at different film positions Since the dimensions of the projection figures become smaller as we proceed from the cathode to the anode end of the film, it follows that sharpness of shadow will also improve in this direction In addition except at the center of the film where

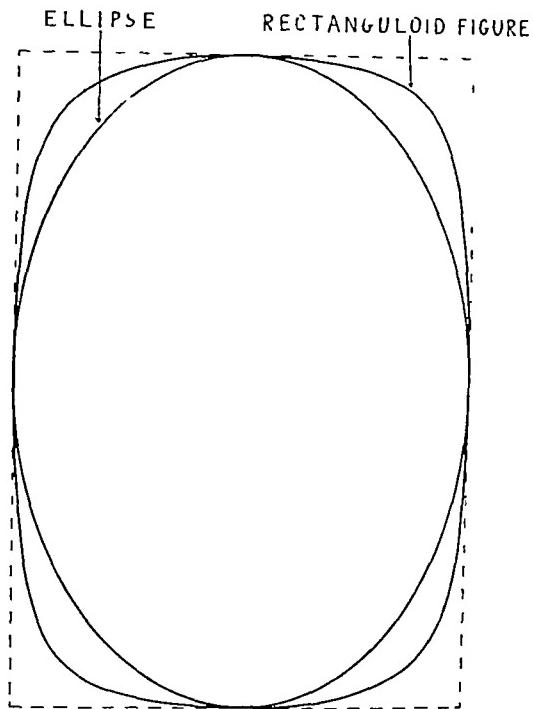


Diagram II Elliptical and rectanguloid focal spot shapes in a circumscribed rectangle.

ure These characters are also shown in Diagram VI

Since the focus of a tube is so widely variable, it is necessary to deduce a practical or *effective* focus that may be used as an index to radiability over a film as a whole In a former publication³ it has been shown that the average of the longest and shortest diameters (major and minor axes) of the projection figure at the middle of the cathode end of a film (Pos C, Diagram I) offers a fair "effective value" of the focus This value will, of course, vary with the size of the film with the target-film distance, and with the geometric characters (slope, shape, etc.) of the focal spot

(Although the mean of the major and

be shortened and the area therefore decreased, to project as in the lower row, the major axis would be lengthened and the area increased. Unless the focal spot is parallel to the film, it is apparent that a circle may be projected at only one point at a time. In determining the type of elliptical projections that is most desirable, it is, in the first place, fundamental that the most efficient possible geometric shape of projection figure is the circle. That is, a focal spot of given area will produce the greatest possible average sharpness at a point on a film, if the shape of the focal spot is such as to give a circular projection figure at that point. There remains to determine at what point on a film the circular focus should be projected for the greatest benefit to the film as a whole. The figures in the diagram are the area of focal spot which projects unit focus at the point depicted. The data refer to a 17-inch film length at 24 inches target-film distance.

It will be observed from the diagram that efficiency at the cathode end of the film is greatest when the circular focus is projected at that point. Since this projection has been shown to be the most reliable index to radiability over the film as a whole,³ it would seem desirable to design the focal spot to give the greatest possible efficiency at this location. There are, however, certain objections to this type of projection:

1. The gain is localized, and is obtained at the expense of efficiency over the film as a whole (see center and anode positions, and mean efficiency).
2. Symmetric distortion of shadow is obtained only where the focal spot projection is circular, hence the inevitable distortion of shape of shadow will be at a minimum when the circular focus is projected at the center of the film.
3. As film size is increased or target-film distance lessened with a given tube, the resulting changes in projection are least unfavorable when the circular focus is projected at the center of the film.

In view of the above data, and since the

gain is less than 2 per cent under the most extreme conditions, we are of the opinion that this fractional improvement is not

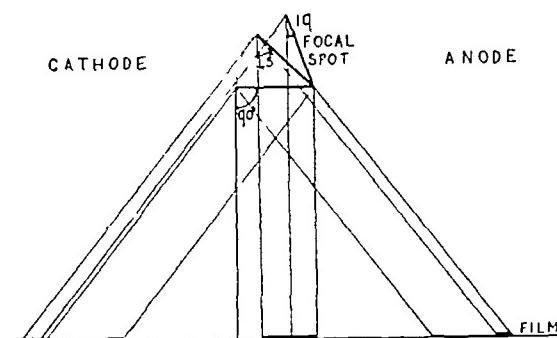


Diagram V Effect of slope of anode on film projection

earned and that the circular focus should be projected at the center of the film.

Projection of the circular focus at the anode end of the film results in very poor efficiency at the more important cathode end of the film and should not be employed.

The increasing efficiency from the cathode to the anode end of the film is simply an expression of the commonly observed increase in sharpness in this direction.

The Slope of the Focal Spot Surface—The effect on film projection of the angle of slope of the focal spot is shown in Diagram V. As the focal spot surface is rotated towards the perpendicular (perpendicular to the film), it is seen that the projections at the center and at the anode end of the film become rapidly smaller. It is apparent also that the anode end of the film may be placed behind the anode surface of the tube, and no radiation be obtained over this area. From the diagram it is seen that projection conditions throughout the film improve as the slope of the anode approaches the perpendicular. This may be conversely stated, that, for a given film projection, the length (and therefore area and capacity) of the focal spot increases as the anode surface approaches the perpendicular. This is the principle of the line focus tube.

film The conditions are for a 45° slope of anode at 24 inches target-film distance, centered over the 17-inch length of a 14×17 inch film It will be seen that the

jects unit focus remains larger in the case of the ellipse

Although we have been unable to obtain a purely mathematical proof for the general

| CIRCLE PROJECTED AT CATHODE END OF FILM | CATHODE END OF FILM | CENTRE OF FILM | ANODE END OF FILM | MEAN EFFICIENCY FACTOR |
|---|------------------------|-------------------|----------------------|------------------------------|
| | | | | 1116 |
| | S20 | 1073 | 1154 | |
| CIRCLE PROJECTED AT CENTRE OF FILM | | | | 1176 |
| | 804 | 1111 | 1616 | |
| CIRCLE PROJECTED AT ANODE END OF FILM | | | | 1144 |
| | 672 | 1041 | 1720 | |

Diagram IV Efficiency of types of focal spot projection

area of the elliptic focal spot is larger than that of the rectanguloid focal spot for all points of the film, i.e., the capacity and efficiency of the elliptical focal spot are greater. It is also seen that the difference in efficiency is most pronounced at the corners of the film. This is due to the fact that the projection figures' slope outwards at all points other than along the mid-axis of the film. The projection figures from a rectanguloid focal spot under these conditions suffer asymmetrical distortion as shown in Diagram III. The result is an increase in the size of the "effective focus" at a greater rate than that which takes place in the case of elliptical projections.

In contrast to this, the projection figures cast by an elliptical focal spot remain true ellipses under all conditions of slope and thus retain their symmetry over all parts of the film.

Similarly, for projection figures having a smaller area than that of an ellipse of the same major and minor axes, we have shown that the area of the focal spot which pro-

case, we deduce from these data that the ellipse is the most efficient possible geometric shape of focal spot design.

A further disadvantage of the rectanguloid focal spot is that the shadow cast by a small spherical object is given flattened sides, corresponding to the flattened sides of the focal spot, i.e., there is increased and asymmetrical distortion of shadow.

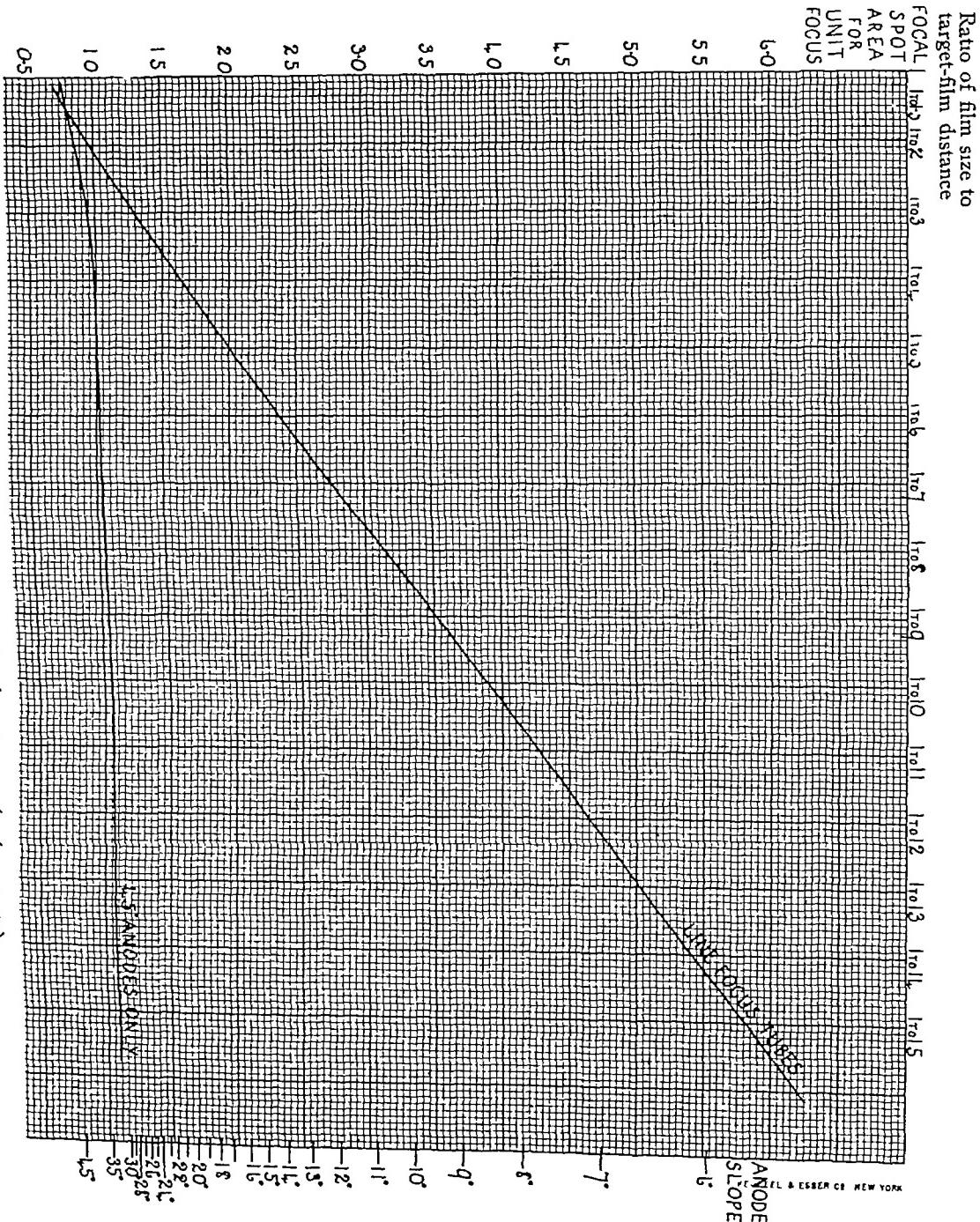
THE RELATIVE DIMENSIONS OF THE FOCAL SPOT

The relative dimensions of the focal spot, i.e., the ratio of the major to the minor axis, is determined for a given slope of the anode by the relative dimensions of the projection figures it is desired to cast upon the film. Diagram IV illustrates different types of elliptical film projections. The middle row illustrates the type of projection figures of the usual 45° anode tubes, i.e., a circle is projected at the center of the film. To project the type of ellipses shown in the top row, the major axis of the focal spot would

film should not be exceeded, and that a lower ratio is preferable when possible.

Relation of Slope of Anode to Focal Spot Area and Capacity—Graph I shows the efficiency of any slope of anode over any size of film at any target-film distance, subject to the conditions that (1) the focal spot is

elliptical, (2) the circular focus is projected along the central ray of the tube, and (3) that a two-to-one ratio between the maximum projection at the cathode end of the film and the minimum projection at the anode end of the film is not exceeded. The efficiency factor as before is simply the area



Graph I Relation of anode slope to focal spot area (and capacity)

This slope is, however, limited by two factors, first, the necessity for radiating the entire film (specifically the anode end), and, secondly, the difference between the maxi-

ferent parts of the film by an elliptical focal spot. In each case at the center of the film the shadow is circular, and the penumbral shadow is of uniform width in all directions.

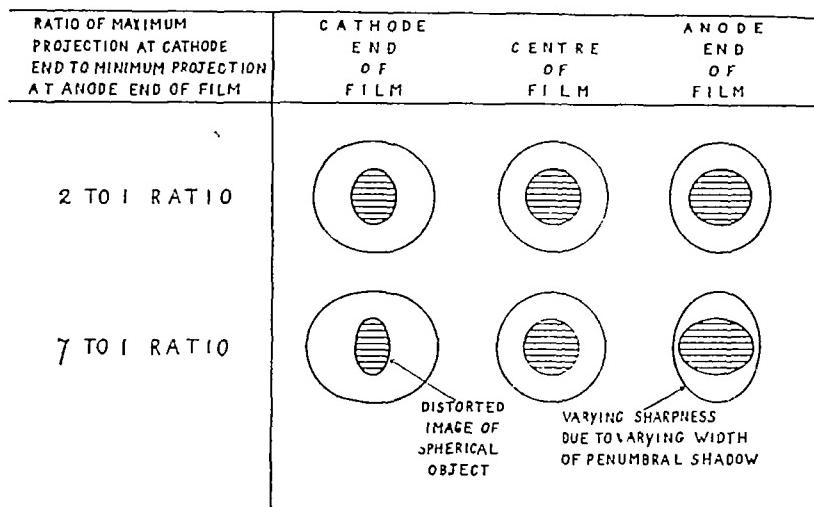


Diagram VI Images of a spherical object at different parts of a film

mum and minimum projection over the film (distortion) that we are willing to allow. Both of these factors are dependent, in addition to the slope of the anode, upon the ratio of the film size to target-film distance in use.

In determining the ideal degree of anode slope, it must be realized that we cannot design a single tube to function with equal efficiency under different conditions. The greater the tube distance and the smaller the film size we are willing to use, the greater the *relative* efficiency that can be designed into the tube.

Focal Spot Projection Ratios—We have first then to set a limit to the ratio of the maximum to the minimum projection that we are willing to permit over a film. This determines the degree of difference in sharpness between the two ends of the film and the degree of distortion of shape of shadow. The radiographic effect of different ratios of projection is shown in Diagram VI. These are the shadows that would be cast by spherical objects over dif-

At this point then the sharpness is uniform in all directions and distortion of the size and shape of the shadow is symmetrical, i.e., the shadow of a sphere is projected as a circle. At the cathode end of the film, however, the shadow proper is flattened and at the anode end of the film it is elongated. In addition, the width of the penumbral shadow (sharpness) varies markedly in different directions in these two positions. The figure shows the radiographic effects of a two-to-one and of a seven-to-one ratio between the projections at the anode and cathode ends of the film. The distortions increase with the ratio of maximum to minimum projection in effect, and we must decide what ratio we are to allow in designing the focal spots.

From the study of a series of such preparations using inanimate objects and living tissues, we have concluded that a ratio of two to one between the maximum projection at the cathode end of the film and the minimum projection at the anode end of the

energy was otherwise not available. However it is preferable to use the film dimension as the basis of computation except when limited by resources of energy or by tube capacity.

Similarly an 18° slope of anode could be used for chest exposures at 65 inches, and have a capacity of 85 per cent greater than that of a 45° anode giving the same sharpness at the same distance.

If in the future we are willing and able to use still greater tube distances, it is seen from the foregoing that much greater relative capacity can be designed into tubes for chest work by using still smaller slopes of anode.

Consider the use of the line focus type of tube in radiography of other parts of the body. Graph II shows, for example, the dimension of film that may be covered by an 18° anode at the shorter target-film distances. Since the conventional X-ray table assembly sets a practical limit in the neighborhood of 36 inches to the target-film distance that may be employed, let us see what radiographic procedures may be legitimately conducted using such a structure.

The graph shows that the limit of film dimension under these conditions is set at eight inches for a 37-inch target-film distance for this particular slope of anode. This permits the use of an 8×10 inch or an 8×12 inch film. These sizes, or smaller, are adequate for exposure of the extremities, including the hip joints and shoulder joints, for the cranium, and for sections of the spine. Radiographs of longer sections of the spine are unsatisfactory in any event, as quite different exposures are required in different regions. Smaller film sizes may be used at shorter target-film distances as shown by the graph. For instance, the 5×8 inch half of an 8×10 inch film may be used for radiographs of the sinuses at 24-inch target-film distance, the long axis of the tube being placed along the 5-inch dimension of the film.

But how, then, is radiography to be conducted when larger film dimensions are needed? In the first place, if it is necessary to expose a 14- or a 17-inch film length at 25-inch target-film distance, it is seen from Graph I that only a 45° anode may be used. In the case of an 18° anode, it is seen from Graph II that for a 10-inch film length (10×12 inch film) a target-film distance of 46.5 inches is indicated, and, for a 12-inch length, a target-film distance of 56 inches is required, *i.e.*, approaching four and five feet, respectively. The choice lies between using these unusually long target-film distances, or using an anode of lesser slope. When possible, the preference should invariably be for the former.

The trend of development in X-ray equipment is distinctly towards the use of generators of large capacity and tubes of increased capacity. The increased capacity made available by the line focus principle should be used to improve sharpness and radiability in detailed structures, and, aside from the attaining of speed where movement is a factor (thorax), should be employed to attain increased target-film distance.

It is apparent that X-ray table equipment should provide for such increased target-film distances in order to keep pace with this trend of developments.

Failing the use of adequate target-film distances, one has the option of using a lesser slope of anode, with consequent lessening in capacity, or of using smaller film sizes, *i.e.*, radiographing more limited areas at a time.

The user of line focus type tubes would do well to construct for himself a graph line for each slope of anode he may have in use. To construct the line as in Graph II, for example, for an 18° anode, proceed as follows. In Graph I, follow the 18° position to the left to the graph line and from thence to the top of the page. This will indicate the ratio of film size to target-film distance to be 1 to

of focal spot which projects unit focus at the middle of the cathode end of the film, the target, of course, being centered

At the right-hand edge of the graph is given the degree of slope, and at the left-hand edge the corresponding area of the focal spot. The figures across the top give the ratio of the film size to the target-film distance. For example, a ratio of one to six represents a film size of four inches at 24 inches target-film distance, or a film size of 12 inches at 72 inches, etc.

The graph in the first place shows the minimum target-film distance at which any slope of anode may be placed without exceeding a two-to-one ratio between the maximum and minimum focal projections. For example, let the long axis of a tube with 20° slope of anode be centered over a 14-inch film length. Tracing the 20° position to the left until it meets the graph line, and then upwards, it is seen that a film-size to target-film distance ratio of approximately 1 to 4.2 may be used. Multiplying each side of this ratio by the film size, we find that a 14-inch film size calls for a minimum target-film distance of $14 \times 4.2 = 58.8$ inches for this slope of anode. If the 20° line is then followed across to the left-hand column, it is seen that 1.70 is the area of this focal spot which will produce unit focus. To compare the efficiency of this tube with that of a 45° slope of anode, reference should be made to the nearly horizontal graph line across the bottom of the page. For the same film size ratio (*i.e.*, 1 to 4.2), it will be found that the area of the focal spot of the 45° anode is 0.99 as compared with an area of 1.70 for the 20° anode. Thus the 20° anode tube has a capacity of $\frac{1.70}{0.99} = 1.72$, or 72 per cent greater than that of the 45° tube under the same conditions.

Similarly a 14° anode is shown to have a focal spot area of 2.38 as compared with 1.04 in the case of a 45° tube. The area

and capacity of the 14° focal spot is thus about 2.3 times greater than that of the 45° tube.

Following the 14° point on the graph line to the top of the page, however, it is seen that the necessary film size ratio is about 1 to 6.0. This means that the 14° anode, if used over a 14-inch film length, must be placed at a target-film distance of $14 \times 6.0 = 84$ inches, or 7 feet. The 45° tube, on the contrary, may be placed as close as 21 inches to a 14-inch film without exceeding the two-to-one projection ratio.

Glancing at the still smaller slopes of anode, capacities of four and five times that of the 45° tubes appear tempting. However, it will be seen that, to use these tubes, target-film distances of the order of 12 to 15 feet must be employed to cover a 14-inch film length as in chest radiography. Such distances are apt to exceed the capacity of commonly used equipment.

Practical Considerations.—The preceding example shows that a 14° slope of anode may be used over a 14-inch film length⁴ at seven feet target-film distance, and has a capacity 2.3 times greater than that of a 45° anode giving the same sharpness. Such a tube then should be useful in radiography of the chest. In determining the minimum target-film distance that may be employed, however, it should be pointed out that some latitude is afforded by reason of the fact that the part radiographed rarely covers the entire film. Thus chests exposed at six feet or more rarely occupy more than 12 inches of the 14-inch film length. If, then, for the case of the 14° anode we provide for a useful film size of 12 inches instead of 14 inches as above, the necessary target-film distance is reduced to $6 \times 12 = 72$ inches or six feet. This reduction might make possible exposures for which sufficient

⁴It is shown in a previous publication³ that the long axis of the tube should always be placed along the short axis of the film and that for stereoscopy the tube should always be tripped in its own lateral axis, *i.e.* along the longer axis of the film.

realized, *i.e.*, the sharpness that may be attained for a given amount of energy is not obtained

5 The anode end of the film may suffer from lack of radiation

SUMMARY

1 The design of the focal spot of the X-ray tube is analyzed in terms of the area of the focal spot in relation to sharpness of focus

2 It is shown that the efficiency of the "line focus" type of focal spot may be substantially greater than that of the 45° slope of anode

3 It is shown that the "line focus" type of focal spot has limitations as to the film distance at which it may be employed. These distances are tabulated for practical use, and it is shown that failure to observe these limitations may lower the efficiency below that of the 45° anode

X-rays Detect Lead Poisoning in Children
—A new method of diagnosing lead poisoning by means of X-rays has been reported by Dr Edward C Vogt, of the Infants' Hospital and the Children's Hospital, Boston. When lead is absorbed into the body it is stored in the bones and can be detected in the X-ray films as a dense band at the growing margin. Its elimination following treatment can also be observed by means of X-ray films

Dr Vogt pointed out that lead poisoning is a frequent and serious condition in children

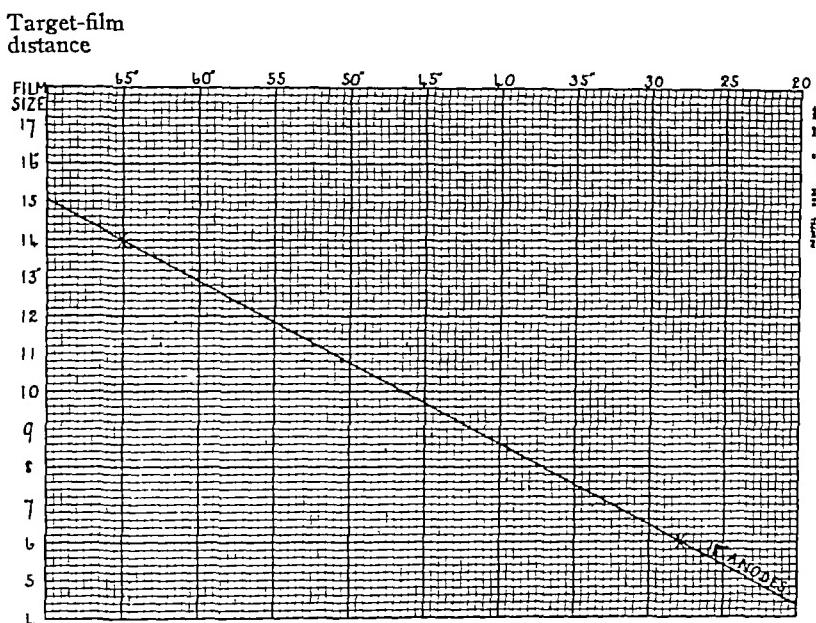
and one not always easy to diagnose. The dark line, called the "lead line," at the margins of the gums is significant of the disease in adults but is seldom seen in small children, and the other diagnostic tests require considerable technical skill

The X-ray test for lead poisoning cannot be used alone, Dr Vogt pointed out, as some other conditions give the same or nearly the same picture, but together with other evidence, such as a history of chewing painted toys, it is very useful.—*Science Service*

465 The target-film distance is thus 465 times the film length. A 6-inch film then calls for $6 \times 465 = 279$ inches target-film distance, and a 14-inch film requires $14 \times 465 = 651$ inches target-film distance. It

measure the angle between this line and a perpendicular to the line representing the axis of the tube

In the case of tubes with metallic discharge chambers, the user will have to de-



Graph II

is necessary only to plot these two positions by crosses and join their centers with a straight edge. Any number of tubes may be thus represented upon a single sheet of co-ordinate paper.

The Determination of the Slope of the Anode—In order to use the material in this paper, it is of course necessary to determine the slope of the anode. The manufacturer should supply these data with each tube as well as the dimensions of the central ray projection of the focal spot. We presume this will be supplied on request. The slope of the anode may be approximately measured in the case of tubes with glass bulbs. Support the tube over a sheet of white paper on which is a long, straight ink mark, and line up the central axis of the tube with this mark by eye. Place a straight edge to coincide in direction with the face of the anode and mark the edge. With a protractor

pend on the manufacturer for these data. Projection methods of measuring the slope of such anodes will be published at a later date, but are not suited to use by the practical radiologist. Failure to observe the restrictions as to target-film distance laid down in this paper may invoke penalties as enumerated below.

1 Undue distortion of shape of shadow, i.e., identical objects may give unduly different radiographic characters of shadow at different parts of the film.

2 There may be undue variation in the degree of sharpness over different parts of the film.

3 Actual sharpness is apt to be defective, as the size of the focal spot is in general adjusted by the manufacturers to be suitable for use at the distances which the slope of the anode permits.

4 The full efficiency of the tube is not

thetic ganglion, brought about no apparent changes in the gland or in its thyroglobulin content. Extirpation of the inferior cervical sympathetic ganglion, however, was followed by diminution in the size of the gland on the side of the operation and a decrease in its thyroglobulin content. He, therefore, concluded that the sympathetic innervation of the thyroid exerts both trophic and secretory influences.

Asher and Flack (1) assumed the existence of secretory nerves to the thyroid gland mainly by reason of the fact that stimulation of the laryngeal nerves brings about the same heightened excitability of the depressor nerve and increased effect of adrenalin on blood pressure as is brought about by the intravenous injection of thyroid preparations. Asher and Rodt (3) also observed that the excitability of the splanchnic nerves is heightened during stimulation of the nerves to the thyroid gland.

In a further experimental investigation, carried out under Asher's direction, Ossokin (11) corroborated the findings of the earlier investigators who maintained that the nerves to the thyroid gland convey both vasoconstrictor and vasodilator fibers. He also reported that vagus excitability is increased during stimulation of the nerves to the thyroid gland. More recently Asher and Pfluger (2) reported experimental findings which seem to indicate that sympathetic denervation of the thyroid results in diminution of the capacity of the body tissues, particularly the subcutaneous connective tissue and muscles for absorption. They concluded, on the basis of these findings, that at least some of the normal functions of the thyroid gland depend on its sympathetic innervation.

In perfusion experiments on the thyroid of the dog, with the nerve supply intact, only by the use of adrenalin could Sturm (13) elicit the discharge of iodine-con-

taining material into the perfusion fluid. According to Vogt (14), partial sympathetic denervation of the thyroid gland in rats and its complete sympathetic denervation in rabbits failed to influence the capacity of the thyroid to adjust itself to wide variations in the intake of food.

The experimental data at hand seem to demonstrate the existence of both vasomotor and secretory nerve fibers to the thyroid gland. The effect of secretory fibers is less evident, however, in the activity of the thyroid gland than in that of certain others, e.g., the salivary glands. Vasomotor changes in the thyroid probably play an important rôle in its secretory activity. The possible effect of direct secretory fibers, however, cannot be disregarded, but the data available at present do not afford a basis for the evaluation of the rôle of these fibers either in the functional regulation of the thyroid under normal conditions or under conditions of hypo- and hyperthyroidism.

On the basis of clinical observations, it must be conceded that hyperactivity of the thyroid gland is accompanied by nervous hyperirritability. The specific effect of the thyroid secretion on the nervous system, however, is not fully known. The data available seem to indicate that the thyroid secretion affects mainly the sympathetic division of the autonomic system, but, under certain conditions, it also affects the parasympathetic nerves. Many of the experimental data bearing on this point are inconclusive. For example, Lieb and Hyman (7) have shown that repeated injections of adrenalin in experimental animals increasingly augment irritability of the sympathetic nerves, regardless of the functional condition of the thyroid gland. In a study of the effect of thyroidectomy on sympathetic irritability, Hoskins (5) was unable to obtain consistent results in the various experimental animals used, probably due to varying effects.

FUNCTIONAL INTERRELATIONSHIPS OF THE THYROID GLAND AND THE AUTONOMIC NERVOUS SYSTEM¹

By ALBERT KUNTZ, M.D., ST. LOUIS, MISSOURI

THE nerve supply of the thyroid gland is derived in part from the cervical sympathetic trunks and in part from the vagus nerves. In man, the sympathetic nerves to the thyroid gland arise mainly from the middle cervical ganglion or, in the absence of this ganglion, directly from the cervical sympathetic trunks. These nerves probably include fibers arising in all the cervical sympathetic ganglia. Nonidez (9) recently described a definite bundle of fibers arising in the superior cervical ganglion and entering the corresponding lobe of the thyroid gland of the dog. He expressed the opinion that the superior cervical sympathetic ganglia are the sources of most of the sympathetic fibers which enter the thyroid gland. Since the thyroid gland develops as a diverticulum from the floor of the embryonic pharynx, a portion of the digestive tube which receives its sympathetic nerve supply chiefly from the superior cervical ganglia, this opinion seems to be well founded. The fibers of vagus origin which enter the thyroid gland are mainly components of the superior laryngeal nerve and include both afferent and efferent fibers. The terminal relationships of the efferent vagus fibers could not be interpreted on the basis of the findings of the earlier investigators. Since the existence of ganglion cells both in the superior laryngeal nerve (6) and the thyroid gland (9) has been demonstrated in certain animals, particularly the dog, it may be assumed that efferent components of the vagus terminate in relation to these cells. They are multipolar and probably represent parasympathetic neurons.

In the light of these findings, it may be

assumed that the thyroid gland, like most of the other visceral organs, is supplied by both sympathetic and parasympathetic nerves. The thyroid gland is abundantly supplied with blood vessels. Not a few investigators have failed to observe nerve fiber terminations in relation to the thyroid follicles or gland cells, and, consequently, have assumed that the nerve fibers which enter the thyroid gland are distributed mainly to the blood vessels. The majority of the more recent investigators who have studied the distribution of nerve fibers in the thyroid gland support the theory that the fibers terminate both in relation to the thyroid follicles and in the walls of the blood vessels.

Certain of the older physiologists, particularly Poincare (1875), advanced the theory that the thyroid gland is supplied by secretory nerves, although experimental data were not at hand. Of the later investigators, some have advanced experimental data which seem to indicate that thyroid activity is subject to direct nervous influences, others were unable, on the basis of their experimental findings, to concur in this opinion. Of the latter group, not a few supported the theory that the secretory activity of the thyroid gland is influenced by the blood supply to the gland, consequently, thyroid activity is influenced indirectly by the vasoconstrictor and vasodilator nerves.

In an investigation undertaken to determine the possible direct nervous influence on the secretory activity of the thyroid gland, Wiener (15) cut the various nerves to the thyroid on one side and later compared the lateral halves of the gland with respect to weight and thyroglobulin content. In his experiments section of the vagus or extirpation of the superior cervical sympa-

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis Nov. 30-Dec. 4 1931

ganglion cells also occur in association with other diseases, including acute and chronic infectious diseases. In infectious diseases such changes must be regarded not as a cause but as a result of the disease. To what extent changes in the sympathetic ganglion cells, indicating hyperstimulation, play a rôle in the genesis of hyperthyroidism is unknown. That sympathetic hyperirritability plays an important rôle in the course, termination, and sequelæ of the disease cannot be doubted.

Although in some cases pre-existing functional disturbance and pathologic lesions of the autonomic nervous system must be regarded as etiologic factors in hyperthyroidism, in the majority this condition probably arises as a primary disease of the thyroid gland. Since certain of its dominant symptoms, including tachycardia, exophthalmos, perspiration, and diminished gastric secretion, are directly referable to increased sympathetic stimulation, probably due to the increased output of the thyroid hormone, it must be admitted that the autonomic nervous system plays an important rôle in the symptom complex associated with hyperthyroidism. This factor merits greater consideration in the treatment of the disease than is usually accorded it, since the sympathetic hyperirritability resulting from this disease, or associated with it, in turn affects the thyroid gland unfavorably. Measures which tend to restore the functional balance of the autonomic nervous system, therefore, would also tend to remove one of the chief sources of irritation of the thyroid gland.

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of this procedure on the sympathetic and parasympathetic divisions of the autonomic system

The results of experimental studies reported recently by Bergwald and Kuschinsky (4) are more significant. These investigators have shown that thyrotoxicosis, induced by the administration of thyroxin, results in sympathetic hyperirritability by reason of an increased output of adrenalin, *i.e.*, thyroxin poisoning results in increased secretory activity of the adrenal glands. These results strongly suggest that sympathetic hyperirritability in cases of hyperthyroidism may arise as an indirect result of the stimulating effect of the increased output of the thyroid secretion on the adrenal glands. These investigators also showed that the direct action of thyroxin is essentially peripheral. Certain observations of Oberdisse (10) also indicate that thyroxin in the blood stream may exert a direct effect on the tissue elements.

Although the results of experimental investigations show clearly that the thyroid gland is subject to nervous influences under experimental conditions and that the thyroid secretion acts as a sympathetic stimulant, the functional interrelationship of the thyroid gland and the autonomic nervous system, as suggested by the experimental data, is not clear-cut. Whatever influence the thyroid secretion exerts on the nervous system probably is exerted mainly on the sympathetic nerves. Under certain conditions, however, it also influences the parasympathetic nerves. This non-specific action of the thyroid secretion cannot be explained on the basis of any experimental data available at present.

In view of the fact that the results of experimental investigations fail to show a constant and clear-cut functional interrelationship of the autonomic nervous system and the thyroid gland, it is hardly to be expected that the clinical picture in thyroid disease should be constant and clear-cut. The domi-

nant symptoms of hyperthyroidism, *viz.*, tachycardia, exophthalmos, increased metabolism, fever, etc., are manifestations of sympathetic stimulation. The hyperperistalsis, which so commonly is associated with hyperthyroidism, on the other hand, is a manifestation of parasympathetic stimulation. The functional balance of the autonomic nervous system is disturbed, but the symptom complex as a whole suggests neither clear-cut sympathetic tonus nor clear-cut vagotonia.

In the genesis of thyroid disease, the importance of a pre-existing functional imbalance of the autonomic nervous system is unknown. Data are not wanting, however, which support the theory that hyperthyroidism is of neurogenic origin in certain cases. Not infrequently the symptoms of hyperthyroidism may be recognized in the absence of any demonstrable lesion of the thyroid gland. In certain cases, it has also been possible to trace the cause of thyroid hyperactivity to a specific lesion of the cervical sympathetic. For example, Herzen reported a case of unilateral thyroid hyperactivity due to compression of the cervical sympathetic by a fractured clavicle. In this case, the symptoms of thyroid hyperactivity subsided following removal of the pressure by reduction of the fracture. Symptoms of hyperthyroidism brought about by stimulation of the thoracic sympathetic trunk also have been reported. According to Stammle (12), Mogilnizky (8), and others, hyperthyroidism frequently is accompanied by pathologic changes in the autonomic ganglia and ganglion cells. These changes have been studied mainly in the ganglia of the sympathetic trunks, and are such as would suggest hyperactivity of the sympathetic ganglion cells. There is also a degree of parallelism between the severity and duration of thyroid hyperactivity and the extent of the changes in the sympathetic ganglion cells. Similar changes in the autonomic

ganglion cells also occur in association with other diseases, including acute and chronic infectious diseases. In infectious diseases such changes must be regarded not as a cause but as a result of the disease. To what extent changes in the sympathetic ganglion cells, indicating hyperstimulation, play a rôle in the genesis of hyperthyroidism is unknown. That sympathetic hyperirritability plays an important rôle in the course, termination, and sequelæ of the disease cannot be doubted.

Although in some cases pre-existing functional disturbance and pathologic lesions of the autonomic nervous system must be regarded as etiologic factors in hyperthyroidism, in the majority this condition probably arises as a primary disease of the thyroid gland. Since certain of its dominant symptoms, including tachycardia, exophthalmos, perspiration, and diminished gastric secretion, are directly referable to increased sympathetic stimulation, probably due to the increased output of the thyroid hormone, it must be admitted that the autonomic nervous system plays an important rôle in the symptom complex associated with hyperthyroidism. This factor merits greater consideration in the treatment of the disease than is usually accorded it, since the sympathetic hyperirritability resulting from this disease, or associated with it, in turn affects the thyroid gland unfavorably. Measures which tend to restore the functional balance of the autonomic nervous system, therefore, would also tend to remove one of the chief sources of irritation of the thyroid gland.

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THE SURGICAL ASPECT OF THYROTOXICOSIS¹

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ASOLUTION of the matter under discussion is simplified, we think, by asking ourselves four questions (1) How does the problem in general impress a surgeon who has studied it for many years in a large number of patients? (2) What sort of individuals are these who are subject to this ailment? (3) What manner of clinical course is characteristic of it? (4) What therapeutic measures seem logical to one who has spent a large part of his professional life in trying to answer the first three of these four questions?

We realize that we are not addressing men who represent a cross-section of the medical world, but that our remarks are directed toward highly trained specialists who do not now practise, and many of whom never have practised, general clinical medicine. Hence possibly we do not see eye to eye, however desirous we may all be of keeping the open mind in every discussion of this sort. What follows has, therefore, no personal slant, since the men to whom this is presented probably see all of these patients in the capacity of consultant, whereas the real odium which attaches to therapeutic failure is in most instances to be borne either by the physician who first sees the patient or, indeed, in this malady of them all, by the patient herself.

Toxic goiter will, we think, impress us with its grave potentialities only when we consider that it gravely affects the three vital systems without any one of which life is not possible for more than a minute or two. We refer, of course, to the central nervous system, the circulatory system and the respiratory system. Thyrotoxicosis in its gravest form is surely recognized by circu-

latory manifestations which are well known to you all, by nervous manifestations which are easily apparent to a casual observer, and by respiratory alterations which present themselves to all students of basal metabolism and to those conversant with our own work on the duration of voluntary apnea.

With this background of physiology in mind, let us ask ourselves if the malady is satisfactorily treated to-day. We were hardly able to answer this question until we made mortality studies on all the goiter patients who died in our service during the past six years. To our astonishment, and we may add to our melancholy satisfaction, we found that 38 per cent of these deaths occurred before operation, something which seems almost incredible in view of the promise held out to us a few years ago—that Lugol's solution would prevent what were termed “medical deaths” in thyrotoxicosis. Now, to make our position more clear as to who is blameworthy, we will add that 80 per cent of those who died without an operation had had a goiter from 8 to 30 years and, what seems even less credible, that 65 per cent of them had been toxic for more than one year.

These surely are figures which give all of us, physicians as well as patients, pause for thought. How is such a condition of affairs possible in an enlightened age, with the laity rather acutely aware of most of its own needs and the medical profession surely well trained? Mature thought along these lines has convinced us that there are two factors which stand out above all others in explaining this situation. In the first place the thyroid patient is, as a rule, highly stimulated, and fails to sense her own need, or to regard herself as a sick person. In the second place, the physician at large is a highly com-

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting St. Louis, Nov. 30-Dec. 4, 1931.

placent individual when it comes to a study of this subject. One cannot otherwise envisage the policy of inaction or procrastination on the part of both patient and physician which leads to a situation such as that outlined above. If our figures mean anything, surely the patient and the doctor are playing with fire.

A further perusal of our records would indicate that the general practitioner does not recognize in toxic goiter any greater potential menace to the patient's health and life than he concedes to the general run of what he conceives to be surgical affections, among which appear many cases of hernia, varicose veins, hemorrhoids, ingrown toe nails, etc. We come to this conclusion because, for the past year, 42 per cent of our general surgery, exclusive of goiters, has been referred by practising physicians, whereas only 40 per cent of our goiters—with all their possibilities for disability and death—have been sent to us by physicians for treatment. This is almost incomprehensible to one who has seen 38 per cent of all the thyroid patients he has lost in six years die before they could be sufficiently rehabilitated for a surgical operation.

Let us continue with the results of our mortality studies as they were impressed upon us by the remaining 62 per cent, those who died following operation. Definite symptoms of toxicity had been present for over one year in this group. Of the patients dying after operation, death occurred in crisis, in afebrile circulatory failure, and from complications in about equal numbers. All of those dying in thyrotoxic crisis had been toxic for over 10 months, with one exception and were, with one exception, under 50 years of age. Those dying in afebrile circulatory failure were, with one exception, over 50 and had had their goiters for periods ranging from 10 to 26 years, only one, however, had had toxic symptoms for more than six months. The circulatory

systems of persons past middle life obviously stand poorly the added imposition of thyrotoxicosis. Again we are compelled, by a study of the patients who died following operation, as well as of those dying without it, to the conclusion that we were forced to receive these patients into a surgical service at a period of their illness when surgical treatment was attended by an unduly grave risk, one which we are hardly called upon to accept when confronted by the general run of patients.

The second question which we have undertaken to answer is, What sort of individual is the subject of thyrotoxicosis? If this is to be answered satisfactorily we must, we believe, look at the ailment as a phase of an existence into which it logically fits itself, in other words, the patient who presents herself with this malady was born possessing a potentiality which does not exist for the rest of us. If we may for a moment digress, the same line of reasoning must obtain for the rest of her life if a recurrence of the malady is to be prevented after we have succeeded in restoring her to health. The prime factors which would, in the light of our own experience, seem to merit consideration as causal factors are (1) instability of the patient, (2) undue physical or mental stresses, and (3) presence of a pre-existing simple goiter.

The first of these three influences was brought out in no uncertain manner among the troops overseas in the late war. A certain degree of instability was easily overlooked. The young man went overseas where the stress, both emotional and physical, was beyond anything that troops had previously endured, with the result that thyrotoxicosis developed in a wholly unexpected percentage of cases. We believe our own figures, quoted above, are fairly representative of the fact that very many patients have been aware of a thyroid tumor long before the appearance of toxic symptoms.

The third question to be answered must regard the character of this malady. We must surely have a true understanding of its life history if we expect to combat it successfully. It must be fully understood that its course is marked by *remissions* which are to be regarded as *automatic* in character, though, of course, they may be influenced—and, indeed, precipitated—by certain forms of treatment to be detailed later. These remissions usually persist for some months after the patient has experienced an incapacity of a somewhat similar duration. It may be added, one regrets to admit, that a complete *restoration* to health, which is spontaneous in character—that is, a symptomatic cure—is exceedingly rare. In a wide experience extending over many years, we are absolutely certain of this having occurred in only one patient. Perhaps we may except those occasional "burned-out" sufferers who have managed somehow to exist through some ten (average) exacerbations, only to attain at last a permanent subthyroid state, accompanied by irreparable damage to the heart and parenchymatous organs. If *restoration* is to be brought about at all, it must be *constructive* in character as opposed to the remission which we have termed *automatic*, upon this consideration will be based our suggestions for treatment.

(One phase of the subject should not be passed over lightly, but the limits of this paper do not permit us to go deeply into it namely, the diagnosis. There is a very considerable percentage of patients in whom it is most difficult to know whether we are dealing with thyrotoxicosis or some one of the many emotional or psychic conditions characterized by vascular and emotional instability and other phenomena which also characterize the thyrotoxic patient. We hoped at one time that the basal metabolism determination would help us out in this connection, but we will remind you once more that, during the remission the basal metab-

olism may be quite within normal limits and this fact has led to confusion in diagnosis. However, these two classes of patients must be sharply separated unless disappointment and something like disgrace are to follow the removal of an enlarged thyroid for symptoms which have not been of thyrotoxic origin.)

The individual and not the disease is to be studied. With this in mind we are presenting quite briefly the nine criteria by which, in our own service at least, an attempt is made to estimate the severity of thyrotoxicosis and to formulate therapeutic indications in each patient who presents herself

1 *Heredity*.—We can dismiss this matter with a mere statement that the ancestors of every individual determine to some extent the quality of tissue he brings into this world and the indefinite something which we will call (for want of a better term) his life expectancy.

2 *Age*.—Much observation in many hands has shown that the thyroid patient under 18 and the one over 50 years of age carry distinct handicaps with them. A surgeon feels that he cannot take away a relatively large percentage of thyroid tissue in childhood or early youth without interfering with growth, development, etc. On the other hand, he risks a high percentage of recurrence in these young patients by leaving too much thyroid tissue. The patient over 50 presents quite another sort of consideration, for she has not the physical reserve to meet any emergency in the same way she would have done on the sunny side of the half century mark.

3 *Duration*.—The long-continued existence in the toxic state tends, in the course of time to bring about parenchymatous changes in all the organs, though the long-continued presence of the thyroid tumor itself may have meant very little in a mechanical sense.

4 *Circulation*—The increased oxygen need, which characterizes thyrotoxicosis, is met in part by cardiac over-activity which leads, in the course of time, to something akin to the state that is suggested by the overworked race horse which has been pushed unmercifully in the last quarter until the point of exhaustion has been reached.

5 *Excretion*—In this connection we refer in passing only to sweating, diarrhea, vomiting, bronchorrhea, and the changes in kidney function which are seen in the advanced stages of the disease. We realize, of course, that it is difficult to separate the rôles played by secretion and excretion in a study of this phase of the malady.

6 *Nutrition*—No better evidence of thyrotoxicosis can be elicited than a history of rapid loss of weight, especially if accompanied by a ravenous appetite, provided, of course, that diabetes be excluded. However, this cannot always be done because the two maladies run concurrently more often than is supposed to be the case. It must be understood that nutritional decline is always to be regarded as involving one of the worst prognostic indications.

7 *Self-control*—A partial or complete loss of self-control is to be regarded as very serious in every instance, and, when a true psychosis has developed in such a patient, the likelihood of a fatal outcome is much increased. This is especially true if anything of a surgical nature is undertaken.

8 *Metabolism*—This index of the severity of the disease is too well known, we think, to justify us in any extended consideration of it, but it varies widely in each individual at different stages of the disease.

9 *Duration of Voluntary Apnea*—In recent years it has seemed to us that study of a patient's ability to hold her breath has given a criterion which teaches us more about the patient's vital reserve than does any other single one at our command. Indeed, it reflects something of that which is

imparted by a study of three other criteria, namely, circulation, self-control, and basal metabolism. A preliminary report along these lines was presented by one of us, the junior author, to the American Society for the Study of Goiter at the Seattle meeting in July, 1930. The pearl-diver can hold his breath an unbelievably long time, Jackson and Lees, who examined 100 healthy students, found the duration of voluntary apnea to be 72 seconds after inspiration and 34 seconds after expiration, we find occasional strong men in whom it is 100 after inspiration and 50 after expiration. Contrast this with the lowest figures we have observed in a goiter patient who could hold her breath only five seconds after inspiration and an equal length of time after expiration. As a graphic portrayal of just what this means in thyroid surgery, we will say that in July, August, and September of this year we felt justified in doing thyroidectomy on the patients who entered the hospital with an average DVA of 47/24, but nothing more than ligations on those who came in with an average DVA of only 22/13.

The fourth question which we are asking ourselves is, What shall be done by our profession about the goiter problem? As we see it, experience forces upon us the following concept of the whole goiter matter. There must be, first, a considerable period, if the individual is very sick, for *rehabilitation*, the average duration of this period being about one year. This is succeeded by what may, for want of a better term, be called a *maintenance* period, which lasts as long as the patient lives and is devoted to maintaining an adequate level of health and prevention of recurrence. The rehabilitation period, so-called, consists of three phases. We formerly called the first one "preparation for operation" and the third one "after-treatment, immediate and remote," these two being separated from

one another by the second phase, a surgical procedure calculated to decrease greatly the amount of thyroid tissue. We do not now think it fair to the patient to separate these three phases of rehabilitation. We rather consider it essential to inform her when she is first seen that the rehabilitation is going to take a year and that the three phases of it are of about equal importance.

There are five measures at our command which shorten the first phase of rehabilitation during which the extremely sick individual improves to that point at which safe removal of the thyroid tissue can be contemplated. They are the use of (1) rest, (2) iodine, (3) radiation, (4) the injection of various substances, and (5) superior pole ligations.

It is impossible to state the exact value of any one or all of these five measures, since thyrotoxicosis is characterized by cycles in which a marked improvement appears periodically whether or not the patient is treated. It is only since we learned to do our operating in these periods of spontaneous or induced remission that the surgical mortality has approached a figure which justifies a continuance of thyroidectomy.

Our operative attack upon the gland should never be considered an emergency measure, on the other hand, if it is so employed, tragedies are very certain to be frequent. We are displaying a patient, Mrs G., on whom we employed radiation in a way which may be novel to many. Hers was such a stubborn case that on Sept. 17, 1931, we cut flaps as for a thyroidectomy completely exposed the anterior surface of the thyroid gland, and, with the wound open gave her the following exposure: 5 5-inch spark gap, 3 ma, 1 mm aluminum filter, 22-inch distance 5 minutes. The layers covering the thyroid were completely restored and the wound healing was uneventful. We have not performed this on a second patient preferring to wait six months to be sure that no permanent harm

has been done to the parathyroids or other important structures in the field thus exposed. We were led to radiate the patient in the manner outlined because, after cutting flaps, her condition became such that a continuation of the operation seemed inadvisable. With the flaps opened, it was apparently possible to do more than is accomplished by radiation when the integrity of the skin has to be considered.

The third phase of rehabilitation, the after-treatment, terminates in many hands when the patient leaves the hospital. A very great deal is gained by continuing to observe and advise the patient until a year has elapsed from the time when she was first seen. In this way one avoids the many errors which are inevitable from a too early return to work or to the numberless other reactions which can mean harm for the patient who has nothing but her own inclinations and experience to guide her. The period of life maintenance is not one of strictly *medical* treatment, but should, rather, consist of occasional *supervision* on our part and of *co-operation* on the part of the patient. It is only by some such arrangement that recurrence is to be prevented in a certain small percentage of cases, variously stated by different authors as up to 6 per cent. We send our patients home with instructions to take a small amount of iodine, one to three drops of Lugol's solution each day, feeling that thyroid metabolism is rendered less arduous if we are justified in the assumption that a gland which finds its work easy is less likely than another to undergo a compensatory hypertrophy.

The observer who has traced many of these thyroid patients through the years following the operation has long since become convinced that their judgment about themselves is in many instances not to be trusted. These patients, more than any others seem prone to the forms of indiscretion and immoderation which incline them toward a recurrence of their symptoms. They seem

often not to need a physician so much as they do need a custodian. Surely a judicious mixture of medical and custodial care is needed if these individuals are to remain healthy and useful after their period of rehabilitation is at an end.

CONCLUSION

It seems to us that there should be a complete understanding between the radiologist and the surgeon as to the field of usefulness of each in the treatment of goiter if they are to be mutually helpful in the highest degree to the patient. As we see it, there is involved absolutely no conflict of their interests. Each is more definitely useful than the other during a certain period of the goiter patient's treatment. Neither of them cures her, indeed, the word "cure" has not been used in this paper, advisedly, because the basis of the malady which we are discussing is unknown. What we do is to treat a syndrome and all we hope to accomplish is a certain *stabilization* of these patients which may, and should, remain permanent.

The period of usefulness which we, as surgeons, are definitely relinquishing to you, the radiologists, is coincident with the first stage of rehabilitation, that is, while we are trying to reduce thyrotoxicosis to the point at which surgery becomes safe. Radiation, during the period which we formerly called "preparation of the patient," is certainly not dangerous, and is surely efficacious at a time when the operative removal of thyroid tissue is absolutely dangerous. On the other hand, we would reserve for the surgeon the period which begins with the remission of symptoms. In other words, the thyrotoxic patient has passed through what may be broadly termed her crisis or at least her critical period, and has, with the aid of radiation, returned as nearly to the normal as may be possible with her gland in place.

Then, and not until then, the removal of about nine-tenths or even more of her thyroid tissue transforms this temporary remission into a permanent restoration to her normal status, provided, of course, that the proper sort of follow-up is contemplated. This selective procedure may, we think, be termed one of a quantitative nature since the removal of half the thyroid (one lobe) does not accomplish at all the same thing. (Nothing would be more desirable from the patient's point of view than the development of radiologic or other treatment which would remove or destroy nine-tenths or more of the thyroid gland without at the same time imperiling parathyroids and other important structures, to say nothing of producing complete hypothyroidism.) However, it would seem that mechanical removal, complicated as this procedure may seem when compared with radiation, must for the time being give the only promise of removing just the large proportion of thyroid tissue which is undesirable, and of leaving behind at the same time just the vastly lesser proportion which is indispensable to the continuance of the patient's health.)

From the foregoing it will appear that we do not consider either thyroidectomy or radiation the absolutely *vital* procedure in our treatment of thyrotoxicosis. Both are important within their own fields of usefulness. In the broadest sense, however, this is from first to last rather a problem of clinical management during a period which begins with the introduction of the patient to us and ends only when her measure of usefulness or, indeed, of existence is over. Does any radiologist wish to assume the sort of responsibility here involved? We think not. We hope not, at least, because we consider the radiologist far too useful a member of the medical profession in another capacity to permit him to employ his time in extended clinical pursuits.

THE SURGICAL TREATMENT OF THYROTOXICOSIS¹

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HERE can be but one purpose in discussing the surgical treatment of thyrotoxicosis before this Society—that of giving a basis for comparison with the radiologic treatment. In this way only is it possible to estimate the relative value of the two procedures. To begin, therefore, there must be a definition of the terms used, otherwise, there is likely to be much misunderstanding.

I shall confine myself to the subject of thyrotoxicosis, which is a toxemia, and entirely disregard the term "goiter," referring to mere enlargement of the thyroid gland, which is not of concern in this discussion. Since we are interested in a comparison of the results obtained by these two methods of treatment for thyrotoxicosis, our evidence must show first, that the patients treated were really thyrotoxic, and, second, that the results of treatment are as stated and substantiated by adequate study.

A diagnosis of thyrotoxicosis can be made only after a personal study of the patient. It is evident that the status of the patient, when he first comes for treatment, can be determined only by means of personal, clinical, and laboratory examinations. In addition to the history and physical examination, laboratory tests give important diagnostic information. It seems equally evident that an estimate of the post-operative condition, that is, the results obtained by treatment, must depend equally upon skillful clinical and laboratory studies. Obviously, then, it is impossible to depend upon correspondence for furnishing the diagnostic information. Neither a report from the patient himself as to subjective symptoms, nor a report from the family physician con-

cerning objective findings can be used as a basis for critical study. It is not true that the patient is the best judge of his own condition. His estimate is likely to be faulty and misleading, depending to a great extent upon his emotional make-up. An outstanding symptom of thyrotoxicosis is increased nervous irritability, a symptom present in many other disorders, and one which is quite likely to interfere with subjective observations of any sort.

The personal contact between physician and patient is of the greatest importance in clinical medicine. It is only through securing a complete anamnesis and by making a careful physical examination that an accurate diagnosis is possible. In addition, students of thyroid disease are practically agreed that repeated studies of the basal metabolic rate form another objective basis for judgment of the patient's condition. It naturally follows, therefore, that those who discuss thyrotoxicosis must be able to vouch for the clinical evidence and for the accuracy of the metabolism studies made on the patient.

The case reports which form the basis for this presentation are those of patients who were given this type of careful study. The majority of the metabolism tests were made by skilled technicians in my own laboratory. The remainder were made in laboratories for which I, personally, can vouch. All cases in which this type of data was not available were excluded from this study. To eliminate a possible source of error, cases are not included in which pre-operative or post-operative metabolic or other data were obtained by correspondence with the patient or his physician. In comparing the results obtained by radiologic treatment of thyrotoxicosis with those ob-

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis Nov. 30-Dec. 4, 1931.

tained by surgery, it is necessary that you be equally as critical of your material Patients concerning whom the statement is made, "They came with a diagnosis of thyrotoxicosis," whose metabolism studies were uncontrolled, or those who had no such studies, cannot be included in any scientific study without danger of error Starting with these premises, we shall both be able to talk in exact figures We can eliminate entirely such terms as "approximately" or "about" in making statistical statements

In estimating the results obtained by treatment for any condition, the evidence obtained in the patients on whom the treatment was improperly carried out is not acceptable In treating cancer with the X-ray, if the dosage is too small, the results will be less satisfactory Inadequate resection of cancerous tissue gives equally poor results And so it is with these two types of treatment for thyrotoxicosis We must presume that your treatment is as satisfactory as it possibly can be, and that the surgical procedures undertaken are the most satisfactory type that can be employed It is of no purpose to refer to experiences with patients who were inadequately treated

Both radiologists and surgeons approach the subject of treatment for thyrotoxicosis from the same viewpoint, namely, that the source of the disease is in the pathologic thyroid gland Both types of treatment are aimed toward reducing this thyroid activity

It is my purpose to present the method of surgical treatment which I regard as necessary for obtaining satisfactory results and to give the results obtained by this method, then to compare these results with what the current literature has claimed for radiotherapy in the same disorder If we start with the premise that the pathologic thyroid is the source of thyrotoxicosis, surgical treatment must aim at such radical removal as to bring the thyroid function within normal limits

The normal thyroid, like most parenchymatous organs, has a large factor of safety In other words, under normal conditions, its capacity to elaborate thyroxin far exceeds the needs of the body As with other parenchymatous organs, the amount of thyroid secretion elaborated can be decreased by simple reduction of the mass of the gland Irrespective of the degree of increased secretion that occurs in the pathologic state, adequate reduction of the mass of the gland will reduce the amount of secretion so that it will be within normal limits or may even be subnormal

By using the basal metabolic rate as a measure of the activity of the pathologic thyroid gland, it is possible to control the activity of the gland with the accuracy of a laboratory experiment While the basal metabolic rate may be normal, even though there is excessive thyroid tissue present, an increased metabolic rate can be present only when there is enough thyroid tissue in the body to produce it It follows then that, when the metabolic rate fails to drop to, or below, normal following a thyroidectomy, the surgeon has left too much thyroid tissue in the body

It is further evident that, when surgical treatment is employed, one cannot logically speak of a degree or percentage of cure of a thyrotoxic individual as measured by the metabolic rate The patient is either cured or the operation is a failure The surgical treatment is never a half-way measure, the patient cannot be 50 or 75 per cent cured He must be 100 per cent cured or the operation is a failure Adequate surgical removal of the thyroid gland must result in reduction of the metabolic rate to, or below, normal The entire structure on which we base both surgical and radiologic treatment must fall to the ground if we admit of the possibility of a single exception to this statement

Total removal of the thyroid gland is not

permissible Some thyroid tissue must be left in the body It has been suggested that this residual mass can, and often does, undergo hypertrophy and hyperplasia, with resultant failure of the operation and a recurrence of the symptoms of thyrotoxicosis

It is impossible to use the terms "failure" and "relapse" interchangeably—they represent entirely different conditions The failure of an operation is directly due to removal of insufficient thyroid tissue, and must be charged against the surgeon rather than against the principle involved Although this failure is manifested by a continuation of the disease, the symptoms are less marked because there has been some reduction of the thyroid mass, but insufficient reduction

Often the condition of the patient may be so improved that he regards himself as cured A careful study, including metabolic rate studies, however, frequently will give ample evidence of continued intoxication If careful post-operative studies are not made on these patients, they are likely to be included in the list of cures Later on, when their symptoms again become more marked as a result of further hypertrophy and hyperplasia of the thyroid remnant, the conditions are regarded as "relapses" But "relapse" signifies only actual recurrence after a real cure of the thyrotoxicosis This means that the treatment employed has brought the thyroid activity to normal The patient's condition is normal for a time, then there is a return of the thyrotoxicosis as a result of growth of the thyroid mass left at operation While such relapses are undoubtedly possible, in my experience they are exceedingly rare

Careful studies show that many relapses, so reported, are simple failures caused by incomplete operation The operation which I believe is indicated in the treatment of thyrotoxicosis is radical thyroidectomy—aiming at reducing the mass of thyroid

tissue to the smallest amount which is compatible with normal or temporarily subnormal thyroid activity In practice, this has proved to be about 2 grams of thyroid tissue —1 gram on each side of the trachea In several hundred cases I have left less than this, and in about an equal number I have left from 3 to 4 grams, in an attempt to determine what amount should be left behind in order to produce a temporary hypothyroidism with a return to normal within a short period I have been disturbed by having a number of patients remain hypothyroid for a year or more, due to my having left less than 2 grams of thyroid tissue In view of these facts, I am now inclined to leave 2 grams or more in every case

In a series of 1,235 consecutive patients in whom clinical examination and raised basal rates definitely showed the presence of thyrotoxicosis, I have performed the radical operation, aiming to leave from less than 2 to about 4 grams of thyroid tissue I have been able to follow 1,096 cases for various periods

| | |
|--------------------|-----|
| Less than one year | 195 |
| One year | 288 |
| Two years | 238 |
| Three years | 163 |
| Four years | 124 |
| Five years | 47 |
| Over five years | 41 |

In 159 patients, on one or more tests following operation, the metabolic readings were found to be above normal The cause for the abnormal elevation was evident in all but a few of these patients Nine were pregnant at the time the high readings were obtained Ten had some type of infection, with elevated temperature Thirteen were taking an excessive amount of desiccated thyroid In five cases, basal conditions could not be obtained for psychic reasons In two instances the cause for the high metabolic rates was not evident, and in two others the data were incomplete In all, the

elevations were temporary, the final tests being normal (15 or below)

For varying periods 63 of the patients had elevated rates with a slow but steady drop to normal. It is my belief that more than enough thyroid tissue had been left at the time of operation. I am of the opinion that, in these cases, there is greater likelihood of so-called recurrence of the toxic symptoms.

Continued symptoms of thyrotoxicosis were evidenced by 39 of the patients. Of these, 23 consented to re-operation, which resulted in cure in 21, the basal rate dropping to normal or temporarily below normal. In the 21 patients who were re-operated upon, sufficient thyroid tissue was found present at the time of the second operation to account for the existence of the thyrotoxic symptoms. I also operated upon a considerable number of patients who had undergone elsewhere a primary operation for thyrotoxicosis. In all of these cases, also, sufficient thyroid tissue was present to account for the toxic symptoms.

At the time of the last study, 16 of the patients were thyrotoxic. In two of these, palpable masses of thyroid tissue were present in the neck some time after operation. In one patient the pyramidal process which was left at the time of operation underwent subsequent enlargement. In one patient a lobectomy was performed because one side of the gland seemed normal at the time of operation. In another case, since the patient was only 13 years old, more thyroid tissue was left than was customary.

In three of the 16 patients, normal basal metabolisms were present on two or more examinations, but after a material length of time, symptoms of thyrotoxicosis reappeared. These cases may properly be designated as "relapses." One of these was re-operated upon elsewhere. I performed a second operation on another of these patients and removed a mass of thyroid tissue weighing 15 grams which was all found on

one side of the trachea. On the other side, only a thin layer of tissue was noted. Following the second operation, recovery occurred rapidly. The metabolic rate was -34 per cent 37 days after operation.

To sum up, the results of surgical treatment in thyrotoxicosis in a series of 1,096 cases followed for various periods after operation, 1,057, or 96 per cent, became normal after one operation. Of the 39 patients who failed to become normal, 23 consented to re-operation. Of these, 21 were cured, as shown by return of the metabolic rate to or below normal. The incidence of ultimate success of radical operation for thyrotoxicosis is, then, 98.4 per cent. The incidence of failure, 1.6 per cent, is small. In view of the fact that in three of the cases palpable masses of thyroid tissue could be found after operation, and that in 21 re-operated upon masses of thyroid tissue were found, it is almost justifiable to account for all failures on the basis of faulty surgical technic and removal of insufficient thyroid tissue. The mortality in the series of 1,235 cases was 0.89 per cent. I wish to emphasize once more that, when failure occurs, it is due to leaving too much thyroid tissue at the time of operation.

There is one criticism which repeatedly has been applied to both the surgical and radiologic treatment of thyrotoxicosis, namely, that the removal of the thyroid gland does not eliminate the cause for the disease. The answer to this criticism, which adherents to both of these methods of treatment can give, is that, so far as has been shown, whatever the true source of the disease may be, the symptoms of thyrotoxicosis cannot persist when the activity of the thyroid gland is sufficiently reduced by operative or radiologic methods.

In comparing the results which I have obtained by radical thyroidectomy with those reported in the current literature for radiology, let me point out to you again that the diagnosis in all the cases included in my

permissible Some thyroid tissue must be left in the body It has been suggested that this residual mass can, and often does, undergo hypertrophy and hyperplasia, with resultant failure of the operation and a recurrence of the symptoms of thyrotoxicosis

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again no data in the form of metabolism tests, or accurate analyses and descriptions of the clinical condition of the patients, are given.

A careful study of the German literature on the same subject has proved equally barren of that type of accurate, painstaking observations which are so characteristic of many of the German scientific investigations. None of the papers gives the results of detailed metabolic studies.

I need hardly say that I have the highest respect for the men whose work I have mentioned, but clinical research of this sort is open to criticism on the grounds stated. It must be granted that the mortality and complications of radiotherapy in thyrotoxicosis compare favorably with those of surgical treatment. Yet the apparent difference is not so great as it seems to be. The surgical mortality in those clinics in which a large number of thyroidectomies have been performed is in the neighborhood of 1 per cent, probably a little less than this. Competent surgeons, without special experience in thyroidectomy, may have an average mortality of about 2 per cent. Competent roentgenologists, in general, have a much lower immediate mortality. But what of the late mortality? The patients who are not completely relieved by radiotherapy—who have only temporary relief from their symptoms—continue to carry with them a pathologic thyroid gland. While the radiologic treatment does not produce immediate mortality, yet, with the continued thyrotoxicosis that is present in so many of the cases, there is further damage to the heart and nervous system, and marked shortening of the life expectancy.

There are but few statistical data as to length of life following either surgical or radiologic treatment. Christie's results are apparently satisfactory. A very accurate study of the goiter clinic of the Massachusetts General Hospital showed a remarkably

high late mortality, although the total number of cases included in the study is too small to permit of any definite conclusion. My own late mortality is 26 late deaths following 1,235 thyroidectomies for thyrotoxicosis, distributed as follows:

| | |
|--------------------------------|---------|
| One to six months | 4 cases |
| Six months to one year..... | 5 cases |
| One to two years..... | 5 cases |
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| Number of years not known..... | 5 cases |

I believe it reasonable to assume that the patient whose pathologic thyroid is removed has a longer life expectancy than the one whose thyroid is still present, even though his symptoms are less marked and his metabolic rate has been reduced.

SUMMARY

Radical thyroidectomy was performed upon 1,235 patients suffering from thyrotoxicosis. But few of these patients were not completely relieved of their symptoms by the operation. Re-operation was done upon 23, and, of these, 21 were relieved as shown by clinical symptoms and metabolism tests. One patient required a third operation to secure this result.

Three patients made normal recoveries and had two or more normal post-operative metabolism tests, to be followed by recurrence of thyrotoxicosis. These cases can be properly designated as "relapses." One of these was shown to be due to inadequate removal of thyroid tissue.

CONCLUSIONS

In the hands of competent surgeons, radical thyroidectomy seems to be the most satisfactory treatment for thyrotoxicosis. The evidence presented showing the value of radiologic treatment of thyroidectomy is faulty because of failure to present adequate pre-operative and post-operative studies of the patients treated. The immediate mortality with the radiologic treatment, while

series of patients is based upon personal study, including repeated studies of basal metabolism made under controlled conditions. The state following operation was regarded as necessitating as much study as the pre-operative condition. Cases on which personal studies could not be made were excluded. The radiologic literature, on the other hand, is lacking in the presentation of material that has received this same careful study. Ample experience has shown that the activity of the thyroid gland can be reduced to normal or brought below normal by radiotherapy, and this effect can be maintained. The question arises, then, Can such results be consistently obtained? Unless they can be consistently obtained, one must question the usefulness of this method of treatment.

In a review of the literature of the last five years, but one series of cases of thyrotoxicosis treated by the X-ray is presented in which the patients have been studied with any degree of accuracy. It is the series of 305 patients reported by Groover, Christie, and Merritt (1). In this report it is stated that 305 patients were treated and that 89 per cent of them were cured. The patients were studied for a number of years after treatment, and the gains in weight and improvement in the clinical symptoms are given as evidence of the value of the treatment employed. The pre-operative studies are not stated as having been controlled. The studies of basal metabolism apparently were not made by those who gave the treatment for the condition, and no metabolic data are given.

When the diagnosis is made by practitioners, the results of metabolism tests obtained from varied sources, and the treatment given by entirely different individuals from those who make the diagnosis, the value of the evidence is greatly reduced.

The first report made by Christie and his co-workers appeared in May, 1923 (2). The

results of treatment on 114 patients were given and it was stated that 32 of them were cured. A second report (3) on these same 114 patients appeared in November, 1924, stating that 58 were cured. In other words, apparently some of the patients, at least, were under treatment for a period approximating 18 months. Obviously, when thyrotoxicosis persists for this length of time, permanent damage to the heart and other tissues of the body may result.

Jenkinson (4) presents his results in a series of cases treated by X-ray, 300 of which were observed for about four years after treatment. Although the results were apparently excellent, no data are given to permit the reader to draw his own conclusions.

The very foundation of any study purporting to demonstrate the value of any form of therapy must be first, evidence that the diagnosis is correct, second, careful observations and personal study following the application of therapy to determine what have been the results.

It requires but little experience to realize that the diagnoses with which patients are referred to specialists are often remarkable for their inaccuracy. Too often the apparatus for obtaining a metabolic rate is advertised frankly for its value in increasing the doctor's income, and not often enough for its value in making accurate studies of metabolic disorders. Even data obtained by the better class of internists not specially interested in this type of work may be faulty because their technicians have had but little experience in making such tests. This type of work should be condemned.

In a series of cases reported by Pfahler (5), all types of goiter are grouped together. From the context of his paper, there appear to have been about 500 cases of thyrotoxicosis included. He states that in two-thirds of the cases good results were obtained with X-ray treatments, but here

again no data in the form of metabolism tests, or accurate analyses and descriptions of the clinical condition of the patients, are given.

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low, is misleading in view of the shortening of life expectancy with the incomplete relief from the thyrotoxicosis which may occur in many of the cases

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New Radium Discoveries Made in Canadian Northwest—Two new rich radium-bearing ore veins were discovered at Great Bear Lake, in northwest Canada, just before the winter freeze-up stopped further prospecting. Hugh S. Spence, Canadian Department of Mines expert, has stated at conferences with Washington geologists Mr. Spence as official visitor to the radium strike in Northwest Territories himself aided in the discovery of the new bodies of pitchblende ore.

Earlier reports of the rich finds of Gilbert LaBine, discoverer of the original radium ore deposits, were authenticated by Mr. Spence, who says:

"Beyond any question the pitchblende deposits at LaBine Point constitute a very valuable source of radium. At the present value of radium, ore could easily meet the \$400 per ton cost of shipment to the railroad."

More and larger amounts of pitchblende than yet found, containing, at present prices, from \$6,000 to \$8,000 worth of radium to the ton, may yet remain to be discovered, Mr. Spence predicted. Two of the veins have been traced for distances of 1,400 and 2,500 feet, respectively, and all four seem to run together like the fingers of an outspread hand.

A still larger and more valuable deposit, he said, may be at the "wrist," somewhere to the northeast of the present workings.

Another new strike of the precious pitchblende, twelve miles distant from Echo Bay where the first vein of LaBine's Eldorado Gold Mines, Limited, was located, has already been reported on the ground of the rival Northern Aerial Minerals Exploration Company.

Planes were arriving during all the time of his stay at LaBine Point on the Great Bear Lake, Mr. Spence said. These were carrying prospectors on the look-out for further silver deposits. LaBine's No. 2 pitchblende vein, interlaced with valuable native silver veins, the best so far discovered in the region, assaying some 9,000 ounces to the ton, had roused the hopes of these adventurers.

Only two men were on the ground at the time of Mr. Spence's visit, because of the freeze-up, but mining operations were to be resumed. Fourteen surface pits were being worked in the summer of 1931. The ore obtained from these by hand picking averaged 50 per cent uranium oxide, or about one gram of radium to eight tons of ore.—*Science Service*

THE MEDICAL ASPECT OF THYROTOXICOSIS¹

By CHARLES ELLIOTT, M.D., CHICAGO, ILLINOIS

THE general practitioner, through lack of opportunity to study thyroid diseases *en masse*, is frequently misled in the interpretation of symptoms referable to the thyroid. The patient who early seeks relief at the hands of his family physician may, consequently, lose valuable time before his complaint is accurately appraised and adequate remedial measures applied.

Indeed, even those especially interested in the study of thyroid disease encounter many perplexing clinical problems in the recognition of hyperthyroidism when it presents itself under one of its less frequently encountered, although none the less characteristic, clinical types.

Needless to say, in a disease process the manifestations of which are so closely bound up with the personality of the patient, it is often difficult, at times even impossible, to form an opinion as to the true status of the patient without long-continued observation and consideration.

The family physician or the general medical consultant occupies a strategic position in this respect, especially if he has a thorough knowledge of the personality and responsibilities of the patient. If, in addition he has a comprehensive knowledge of the possibilities as far as hyperthyroidism is concerned, his advice is invaluable.

Much confusion results in the evaluation of symptoms commonly attributed to thyroid disease but induced as well by other processes in which the thyroid gland may also be concerned.

The thyroid gland is an important organ in health and from that viewpoint may be considered a gland of efficiency. It plays an important part in determining the bodily reaction to mental and physical stimuli.

¹Read before the Radiological Society of North America
at the Seventeenth Annual Meeting St Louis, Mo Nov
30-Dec 4 1932

However, it does not act singly in this respect, but rather in conjunction with other vital forces in the body, including the other ductless glands and the sympathetic nervous system.

Among those about us we recognize the dull, stupid, and unsuccessful, the alert, mentally keen, and successful, and the over-stimulated, unbalanced, rarely successful individuals as representing varying grades of individual efficiency—dependent largely, as we now understand it, upon the maintenance of a functional balance of the many forces in the body, including the anatomic nervous mechanism. In all such adjustments, the thyroid gland plays a major rôle.

The normal individual who, through no fault of his own, is forced to superhuman effort in providing support for his dependents during this period of economic depression and unemployment, or the constitutionally unfit individual who assumes little or no responsibility even in normal times, may find himself worried, anxious, nervous, tremulous, sleepless, with cold, clammy, cyanotic extremities. He may complain of precordial pain, palpitation, tachycardia, weakness, and loss of weight—symptoms commonly seen in thyroid disease but manifestly not due to disease of the thyroid itself. The exact reaction picture varies with each individual and represents the unsuccessful mental and physical adjustments of that particular individual to his environment. We speak of this condition as "effort syndrome" or "anxiety neurosis."

Every individual has a limit of endurance beyond which he cannot go without manifesting symptoms similar to those enumerated. It matters not whether these responsibilities are voluntarily assumed or imposed by force of circumstances.

Our Government unwisely drafted men

from all walks of life to fill the ranks of the American Army during the World War, regardless of their mental fitness to assume military duties. As a result, the Veterans' Bureau hospitals to-day are filled with these maladjusted and unfit men, some of whom were previously able to adjust themselves, at least to the extent of self-support, but who now look to the Government for support of themselves, if not their families. It is difficult for them to realize that the war had little, if anything, to do with their present unhappy status. England, more experienced, excluded misfit recruits at the beginning of the draft.

The symptoms thus induced in the presence of a normal thyroid gland are none the less thyroid symptoms when this term is employed in the broadest sense, including associated ductless gland imbalance and disturbance of the sympathetic nervous mechanism.

We speak glibly of the symptoms of infectious diseases as being directly due to the invading organisms, whereas a little reflection must convince us that it is not the bacterial invasion, *per se*, but rather the reaction of the body as a whole to the infection which is directly responsible for the symptoms.

For example, weakness, loss of weight, tachycardia, fever, flushing, sweating, and increased basal metabolic rate, in addition to local findings in the lungs characteristic of incipient pulmonary tuberculosis, are not due directly to the tuberculous invasion but rather to the reaction of the body as a whole to the bacterial attack. The symptoms enumerated are none the less thyroid symptoms because they are observed in association with an infectious disease.

The symptoms of such conditions as effort syndrome or chronic infections may so closely simulate hyperthyroidism as to be indistinguishable from those due to disease of the thyroid itself. In fact, no hard and

fast line may be drawn between the two, and often enough men experienced in the study of hyperthyroidism may not be convinced as to the exact status of an individual patient even after long observation.

It is obvious that therapeutic measures directed at the control of hyperthyroidism in such patients—that is, those in whom hyperthyroidism may be simulated but in reality does not exist—can result only in therapeutic failure and bring discredit to the particular type of therapy employed.

The difficulty, of course, is one of mistaken diagnosis and it should be charged to the internist. In his defense, however, it must be recognized that no absolute rules can be laid down which unequivocally separate the manifestations of a latent infection an anxiety state, or a beginning or low-grade hyperthyroidism. A safe rule is to defer any therapeutic attack on the thyroid, surgical or otherwise, or indeed even the use of iodine until the diagnosis is established beyond any doubt.

A third group, which at times offers great difficulty in recognition, is the so-called thyrocardiac group. Included in this group are patients with cardiovascular manifestations not unlike those seen in other forms of heart disease but in which the usual manifestation of hyperthyroidism—the underlying cause of cardiac disability—is either obscure or entirely overlooked.

The hyperthyroid symptoms are those of long-continued, although low-grade, toxic adenoma. In contrast to the usual heart case, these patients are nervous, alert, often tremulous, with warm, moist pigmented skin, and often eye signs of exophthalmic goiter. Thyroid enlargement may be lacking, glycosuria, when present, is significant.

The basal metabolic rate is increased. A rate of plus 30 or even less, in the presence of heart disease, would be distinctive since an increased basal metabolic rate is, I believe, not a feature of heart disease *per se*.

The heart withstands the drive of long-continued, low-grade hyperthyroidism remarkably well. Often many years may elapse without enlargement. The heart tones are loud and quick, a systolic murmur is often present, hypertension may have been present for years. Later, myocardial degeneration results and enlargement occurs, the apex is found to the left rather than down. Various types of arrhythmia, particularly auricular fibrillation, may be present.

It is characteristic of the thyroid heart that it responds indifferently to digitalis but often surprisingly well to digitalis and iodine. Usually the diagnosis is delayed for years and therapeutic measures designed to control hyperthyroidism are rarely employed until after much damage has been done.

A fourth group, presenting difficulties in diagnosis, is that of hyperthyroid patients who are under partial iodine control. Iodine causes a reversal of the hyperplastic gland toward the colloid or resting state, and a more or less complete, although usually temporary, arrest of symptoms.

Iodine is used to prevent simple goiter and may be administered with good effect in all clinical types of hyperthyroidism. It acts almost as a specific, and, when administered in sufficient amounts in the control of hyperthyroid crises, it may save lives. It is, therefore, a most valuable drug to use in the control of thyroid disease.

All this is known to the general practitioner who is not averse to administering such a harmless yet potent drug to those of his patients who (he suspects) may have hyperthyroidism. His attitude is one of willingness to try iodine in doubtful cases, hoping for beneficial results.

This attitude is fallacious only insofar as it applies to the administration of iodine to patients with exophthalmic goiter in whom iodine causes a marked, although temporary, remission of symptoms. This type of goiter, however, continues in spite of iodine ther-

apy, and much valuable time is lost. As complete a remission probably cannot be accomplished by the administration of iodine at any subsequent period.

When patients under partial iodine control are first seen by a consultant, it may be quite impossible for him to form any opinion as to the patient's thyroid status. Much confusion, therefore, results. Iodine therapy should, I believe, be deferred in all cases of goiter until a positive diagnosis is made and a plan of treatment adopted. This must not be construed to indicate that iodine administration should be delayed even for an hour in the treatment of hyperthyroid crises.

Hyperthyroid crises present many difficulties in diagnosis for the general practitioner. While it is true that these patients may have had a known hyperthyroidism of some degree for years, yet the sudden onset of violent thermal, cerebral, cardiac, or gastro-intestinal manifestations in various combinations, apparently dependent, at least to some extent, upon the individual reaction of the patient, is a very serious matter indeed. Severe general infection, encephalitis, cardiac failure, or an acute surgical abdomen may be simulated. Occasionally patients in a hyperthyroid crisis, with predominant gastro-intestinal symptoms, are rushed to the hospital for abdominal section.

The diagnosis must depend upon the detection of hyperthyroidism as the background of the acute and critical manifestations. It is often difficult, if not impossible, to get a satisfactory basal metabolic rate reading in these patients during the period of crisis. The correct interpretation of such manifestations is, of course, of crucial importance to the patient, for instance, in preventing abdominal exploration and insuring the administration of large doses of iodine by mouth.

Under standard treatment the crisis will

from all walks of life to fill the ranks of the American Army during the World War, regardless of their mental fitness to assume military duties. As a result, the Veterans' Bureau hospitals to-day are filled with these maladjusted and unfit men, some of whom were previously able to adjust themselves, at least to the extent of self-support, but who now look to the Government for support of themselves, if not their families. It is difficult for them to realize that the war had little, if anything, to do with their present unhappy status. England, more experienced, excluded misfit recruits at the beginning of the draft.

The symptoms thus induced in the presence of a normal thyroid gland are none the less thyroid symptoms when this term is employed in the broadest sense, including associated ductless gland imbalance and disturbance of the sympathetic nervous mechanism.

We speak glibly of the symptoms of infectious diseases as being directly due to the invading organisms, whereas a little reflection must convince us that it is not the bacterial invasion, *per se*, but rather the reaction of the body as a whole to the infection which is directly responsible for the symptoms.

For example, weakness, loss of weight, tachycardia, fever, flushing, sweating, and increased basal metabolic rate, in addition to local findings in the lungs characteristic of incipient pulmonary tuberculosis, are not due directly to the tuberculous invasion but rather to the reaction of the body as a whole to the bacterial attack. The symptoms enumerated are none the less thyroid symptoms because they are observed in association with an infectious disease.

The symptoms of such conditions as effort syndrome or chronic infections may so closely simulate hyperthyroidism as to be indistinguishable from those due to disease of the thyroid itself. In fact, no hard and

fast line may be drawn between the two, and often enough men experienced in the study of hyperthyroidism may not be convinced as to the exact status of an individual patient even after long observation.

It is obvious that therapeutic measures directed at the control of hyperthyroidism in such patients—that is, those in whom hyperthyroidism may be simulated but in reality does not exist—can result only in therapeutic failure and bring discredit to the particular type of therapy employed.

The difficulty, of course, is one of mistaken diagnosis and it should be charged to the internist. In his defense, however, it must be recognized that no absolute rules can be laid down which unequivocally separate the manifestations of a latent infection, an anxiety state, or a beginning or low-grade hyperthyroidism. A safe rule is to defer any therapeutic attack on the thyroid, surgical or otherwise, or indeed even the use of iodine, until the diagnosis is established beyond any doubt.

A third group, which at times offers great difficulty in recognition, is the so-called thyrocardiac group. Included in this group are patients with cardiovascular manifestations not unlike those seen in other forms of heart disease but in which the usual manifestation of hyperthyroidism—the underlying cause of cardiac disability—is either obscure or entirely overlooked.

The hyperthyroid symptoms are those of long-continued, although low-grade, toxic adenoma. In contrast to the usual heart case, these patients are nervous, alert, often tremulous, with warm, moist, pigmented skin, and often eye signs of exophthalmic goiter. Thyroid enlargement may be lacking, glycosuria, when present, is significant.

The basal metabolic rate is increased. A rate of plus 30 or even less, in the presence of heart disease, would be distinctive since an increased basal metabolic rate is, I believe, not a feature of heart disease, *per se*.

X-RAY TREATMENT IN GOITER ILLNESS¹

WITH RESULTS REPORTED AND COMMENTS MADE ON 200 INDIVIDUALLY
CONTROLLED CASES

By ALDEN H WILLIAMS, M.D., FACP, GRAND RAPIDS, MICHIGAN

THE literature on hyperthyroidism and the thyropathies presents a wide variation of opinion. The cause of goiter illness, accepted by many, is abnormal activity of the thyroid cells. Emphasis on autonomic imbalance, as a factor, is made by a goodly number. The belief that one is predisposed to the illness by a lack of iodine is quite generally accepted, but some think calcium excess is a predisposing cause, and iodine deficiency of minor importance. We are told that iodine benefits both toxic adenoma and exophthalmic goiter. Then again we are informed that iodine is of no value in toxic adenoma. Some good authorities state that there are no contraindications to surgery, others say this idea is very much open to question. In the one opinion, radiation therapy is temporizing, and curative in the other. The cause of goiter illness begins in the thyroid or elsewhere, subsequently upsetting the thyroid. Goiter histopathology is, or is not, consistent with symptom complex. The thymus has, or has not, anything to do with the disease. Graves' disease and toxic goiter are described as different diseases, or the same disease in different stages, or the same disease with different constitutional sensitivities. Writers emphasize the immediate dramatic cure of symptoms by surgery—others question the cure by reporting a large percentage of sick patients a year or more later. Some institutions emphasize immediate low operative mortality, with recurrences given repeated subtotals and kept out of the morbidity statistics as long as possible.

A well-known neurologist reviewed a

group of over a hundred thyroidectomies and reported myxedema symptoms in over 20 per cent of the cases two years after operation. An internist states, in his book on the non-surgical treatment of goiter, that 30 per cent of the cases that enter his institution for treatment come with a thyroid scar.

All of this contradiction opens a fertile domain for the radiologist to appraise and lures him to chart, in his own field, a course that may lead to a clearer conviction of the successful treatment and end-results.

HYPERTHYROIDISM

Although the exact etiology of hyperthyroidism is not known, it is most probable that thyroid cell activity is an important factor in the cause. If all thyroid cells are removed, normal body activity is crippled.

Surgical, medical, or radiation management modify the clinical picture of hyperthyroidism. If we are treating goiter illness by one method and know nothing of the problem of other methods, we should feel a sense of inadequacy and bewilderment.

Accepting then, as a working hypothesis that goiter illness, known in some of its variations as hyperthyroidism, toxic goiter, and exophthalmic goiter, is caused by excessive or altered secretion of the thyroid gland, we may expect methods which inhibit or destroy function to be curative.

RADIATION TREATMENT

As agents, surgery and radiation have much in common both abolish function in a subtotal degree. Results seem to be very similar in cure statistics. It is said that

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St. Louis, Missouri, Nov. 30-Dec. 4, 1931.

soon pass and treatment of the underlying hyperthyroidism may proceed as usual

Needless to say, no patient should be subjected to therapeutic measures directed to-

ward the modifying of thyroid activity unless the physician has, first, a clear-cut conception as to what part, if any, the thyroid may play in the production of symptoms

River Improved to Bring Radium Ores to Civilization—Eight hundred miles of waterway linking rich radium discoveries with civilization are being improved by the Hudson Bay Company in order that valuable ores newly discovered in the Canadian Northwest Territories can be transported out of the wilderness

The radium ores are worth \$70,000 a ton at present prices and silver ores found in the same workings assay \$3,000 a ton

Airplanes have been used to carry prospectors and miners back and forth, but it will be

more economical to carry the heavy ore by water. Twenty tons of ore were brought out last Summer, but the difficulties were great

Most of the improvements are being made on the Great Bear River, the outlet from Great Bear Lake, on which are situated the new mines. The Great Bear River leads to the Mackenzie, down which some 7,000 tons of freight are carried in the tur steamers each year. One ten-ton scow is the only means of transport at present on Great Bear Lake itself.

—*Science Service*

and follow-up records Some of these incomplete cases may be good for later study Cases of simple thyroid enlargement, without symptoms of illness, are not here considered They may be relegated to a prophylactic study or to cosmetic surgical therapy

There were so many borderline and atypical and mixed cases that I did not feel comfortable in classifying them in definite groups I realize my consideration of the 200 cases generalized as *goiter illness* is also open to some question A few cases were errors in diagnosis in which treatment was started for hyperthyroidism, which may not have been present They were disguised cases and did not check true as we went along, treatment being early discontinued with less harm, I hope, to the patient than might have followed had the error been an operation

A few other cases were thrown out because of abortive treatment brought about by change of mind of the patient, pressure of neighbors, or decision of the surgeon that operation was imperative

In comparing statistics of cure given by different radiotherapeutists, one is puzzled by the great divergence of claims This may be explained possibly by the different types of thyroid illness and the varied severity found in different localities

EXOPHTHALMIC TYPE

In our group of 200, there were 34 cases clinically of the *exophthalmic type* (Figs 1-4 1-B)

Cured, $70^{30}/_{34}$ per cent

Improved, $17^{22}/_{34}$ per cent

Unimproved, $11^{16}/_{34}$ per cent

This tabulation compares favorably with the cure analysis of the whole group

The four failures show the following human documents which are recognized because of familiarity

1 Socially inclined—persisted in parties and nightly movies There was no improvement after four treatments, and the patient was sent to operation

2 The patient, who would not have his abscessed teeth extracted, was told not to return until this had been done (did not come back)

3 This patient is the busy proprietor of a store and insists on fishing and hunting He will not accept his limitations and is still not well

4 In this case, there is some emotional conflict disharmony at home The patient needs a neuropsychiatrist Diagnosis is clouded

Of the six improved cases, two suggested neurasthenic possibility, being worse in the morning and at no time very ill

In the 24 exophthalmic cures (Fig 2) were some of our most desperate cases, and brilliant results, among them were three extreme mental cases of the confused type which became normal and have remained so over the three-year period of our follow-up study

Perhaps in thyroid illness, all statistics should use the word "rehabilitation" instead of "cure," and yet, if the patients are relieved of all symptoms upon which was

TABLE II.—TREATMENT AVERAGES 200 CASES

| | |
|---|-------|
| Average number of treatments per case..... | 10.74 |
| Average time (in months) over which treatments were given..... | 3.65 |
| Average weight at beginning of treatment—per case..... | 124.4 |
| Average weight gain—per case (165 cases)..... | 8 |
| Average weight loss—per case (29 cases) (6 cases showed neither gain nor loss)..... | 4.30 |
| Average pulse rate at beginning of treatment..... | 105 |
| Average pulse rate at end of treatment..... | 84.5 |
| Average lowering of pulse rate (181 cases)..... | 24.2 |
| Average increase of pulse rate (17 cases) (2 cases showed neither gain nor loss)..... | 8.5 |
| Average basal metabolism at beginning of treatment (117 cases)..... | +49 |
| Average basal metabolism at end of treatment (108 cases)..... | +16 |
| Average time (in weeks) before improvement commenced..... | 3.3 |

either method will cure from 50 to 75 per cent of all cases and produce satisfying improvement in from 15 to 25 per cent more.

In this study, I do not wish to set up one method against the other, but to give my own experience of radiation management, and some few comments based upon my observation and survey of surgical treatment, which may broaden the judgment and appraisal of both methods. My hope is that, as time goes on and further work is done in all fields the accumulation of cases, by tolerant and sympathetic collaboration, will reconcile differences and balance the elements of the problem. As the radiologist views this problem, he regrets that in some books, and at some goiter conferences on the general consideration of treatment of thyroid disease, so little space is given to the method of irradiation.

The aim of any treatment is the cure as soon, as permanently, and as surely as possible, and while doing it, to give the patient as much comfort and activity and safety as available.

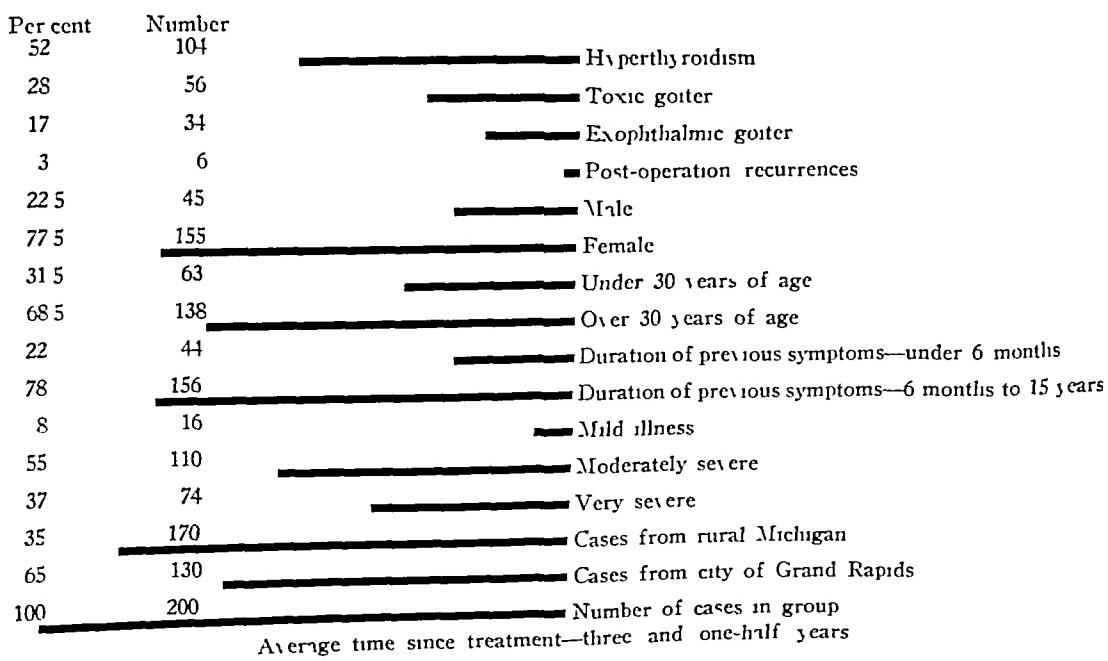
I have been interested in the radiation treatment of thyropaths for 15 years. The longer I have watched results and the more I have followed reports of other methods, the more courage I have accumulated to make this report.

GROUP MATERIAL

In discussing material, it seems impossible to avoid the subject of classification. All of the 200 cases may go, if we wish, under the inclusive class of hyperthyroidism, with decision based upon carefully checked elevated basal metabolism. As in the usual report, subdivisions of toxic goiter and exophthalmic goiter have been arbitrarily made upon consideration of age, onset, symptoms, and physical examination.

The material (Table I) is consecutive and unselected except that, instead of using a larger group of 258 cases, some of which were incomplete, I did elect to throw out 48 cases deficient in preliminary examination, basal data, pulse, weight, progress notes,

TABLE I—CLASSIFICATION OF PATIENTS TREATED



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based the diagnosis of goiter illness, why are they not cured?

In looking over this exophthalmic group, we recognize the controversy aimed at both surgical and roentgen treatment. Without

are vacillating in confidence and need to be frequently realigned and reassured. This is the point at which we failed in the cases that gave up treatment and went to operation, even when they were improving.



Fig 1-A (left) A patient presenting the exophthalmic type of goiter. Before treatment, the weight was 110 pounds, pulse 120, and the basal metabolic rate + 50.

Fig 1-B (right) Same patient is shown in Figure 1-A, after treatment. The weight was 133 pounds, pulse 84, basal metabolic rate + 15.

results to back us up, it might seem illogical to treat or remove surgically an emotionally activated thyroid when a causative mental conflict remains. Possibly we are reversing the rotation of a vicious circle by lessening the hyperthyroidism, which diminishes sensitivity and nullifies the conflict. This lessened conflict, having a diminished stimulation on the thyroid, pyramids the benefit.

In this exophthalmic group, we made a special effort to take plenty of time with quiet visits and personal questioning. The cases seem to be practically unanimous in suggesting a neuropathic personality. They

One radiologist advocates treating by X-radiation only those cases which, by personal conviction, prefer irradiation. I would say if we, ourselves, have a firm belief that a line of treatment is indicated as best and safest, it would seem part of our duty to spread this belief before such a patient if necessary, and to have no lack of courage in commencing and continuing treatment.

The surprising triumph in many cases is not only the change in appearance and personality, but in the confidence toward the treatment as time goes on. Patients be-

come easier to influence and more logical to manage

HYPERTHYROID GROUP

In the hyperthyroid (Fig. 3) group of 104 cases, there were 10 adolescent goiters with increased pulse and basal rate, as the main excuse for treatment. These received an average of four treatments, before becoming normal.

One young girl in this group, who exhibited no imperative symptoms and had a basal metabolism under +20, went to operation two days after our initial treatment. I saw her a year later, with marked symptoms of subthyroid ill-health. A surgeon has no excuse for a hurried diagnosis, for he knows his thyroidectomy is irrevocable.

The number of cases classified as toxic goiter (Fig. 4) made a group of 56, with an average long history of previous attacks and recent flare-ups. These cases represent chronic illness in the later decades of life with variable visceral damage. That is why no quick cure in this type should be expected.

TREATMENT AVERAGES

The average time for the appearance of improvement in symptoms was three weeks, or after the third treatment. This explains why the Holmes group were disappointed in radiation therapy. They arbitrarily made their decision to give three treatments and, if no improvement was apparent, to refer the case to the surgeon. This is like advising roentgen treatment only in pre-surgical cases.

There were several cases with discouragingly long durations of symptoms and treatment, four cases receiving over 25 treatments in seven months, but with complete recovery, and no over-treatment residue.

Treatment is discontinued if the basal rate is near +15 and the weight has increased and the pulse returned to normal.

Of the cases that came to us for irradiation, 3 per cent were post-operative recurrences. Israel Bram, of Philadelphia, reports that 30 per cent of the cases coming to his institution are post-operative.

We reported one of our six post-operative recurrences as a radiation failure. It is a questionable point to decide that the final effort in the case shall assume the entire odium of failure, or flaunt the full credit of success.

We radiologists see the surgeon's failures and he sees ours, and the medical man sees both. Refractory cases in any field need co-operation, and the collaboration of all methods of treatment. One surgeon states that any treatment other than operation is contra-indicated in goiter, because of delay and malignancy possibility.

Carcinoma developed in two of our cases, or 1 per cent.

I have tried to understand the apparent hostility of surgical organizations to other than operative management. I cannot feel that it is imaginary on my part, or, on their part, instinctive competitive guarding of their own field. Radiologists are seldom placed on programs by surgical organizations to discuss their experiences in treating goiter. It may be the surgeon's lack of understanding of radiation treatment and its results, or a natural suspicion of the new, untried, and unknown.

SOURCE OF PATIENTS

Our group had a larger percentage of toxic goiter type than the usual group reported. In trying to analyze this, I find that the greater number of these cases were not referred by physicians or surgeons, while, on the other hand, the majority of the exophthalmic type were cases which had been referred. The roentgen therapist, consequently, is limited in cases referred to him by the decision of his medical and surgical colleagues—that toxic goiter is surgical.

This limitation and clipping of wings is especially true of the full-time salaried hospital radiologist. Hospitals are usually surgical, and in them, instead of the internist be-

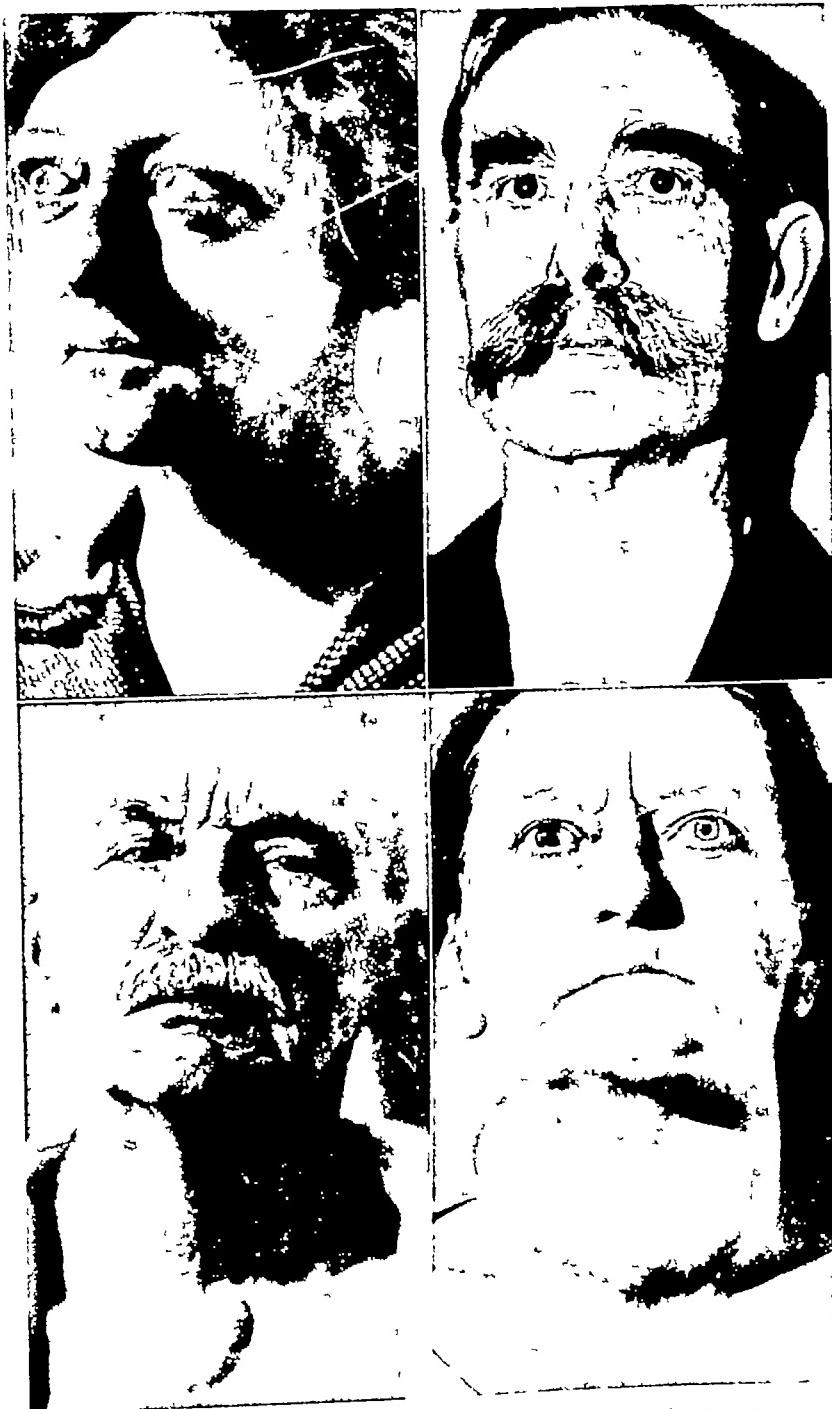


Fig. 2 (upper left) A typical member of the exophthalmic group

Fig. 3 (upper right) A patient suffering from hyperthyroidism

Fig. 4 (lower left) A membe

Fig. 5 (lower right) A case of toxic

ing judge as to the proper treatment régime to be carried out, the surgeon holds dominion over all.

To cloud the issue spontaneous recovery has been suggested as a factor in the radiologic cure, but it seems to me too rare in a mixed group of patients with thyroid illness to be accepted. Improvement under radiation treatment is too uniform to be considered spontaneous. Non-treated, or scientifically neglected cases, do not have a parallel cure percentage.

WEIGHT

The weight gain, as noted often by others, was the best guide to a decision of improvement. Patients who have had a great loss of weight before beginning treatment may be expected to gain the most before being cured. We report an average gain in 165 cases of eight pounds, a loss in 29 cases of 43 pounds, with no weight changes in six cases.

PULSE

The pulse, which, too, is a fairly dependable symptom for diagnostic decision, is also a good calibration of improvement. We report a beginning average pulse rate of 105 in the 200 cases, a decrease of 24.2 beats in 181 cases during treatment, 17 cases showed an average increase of 8.5 beats, and two cases showed neither gain nor loss. The almost uniform improvement of pulse rate during treatment is significant and gives one the comforting feeling that some change for the better is going on.

DURATION OF TREATMENT

The number of treatments required varied, ranging from four to 29 over a period of from six weeks to 10 months. The average number of treatments per case in our group of 200 was 10.74, and the

average time under treatment was 3.65 months.

In studying alone the 74 more severe cases in the group, I find that there were 82 per cent which became well and stayed well for the average of the 4.6 years follow-up period to date. So it would seem that in the group of the worst cases may be found the most striking indication for roentgen treatment.

BASAL METABOLISM

We feel that the basal metabolism is so important as a valuable link in doubtful cases, and as a quantitative element in progress of treatment, that we have thrown out of our study all cases having incomplete basal records. This has left consideration of a smaller group, but I think it has given a greater confidence in possible conclusions.

Basal reports are by no means infallible. One should bear in mind that rapidity of breathing alone raises the basal reading. Remember, also, that the rate has a different meaning, whether the case is spent or on the up-grade. One should own a metabolismeter and know its calibration and peculiarities after many normal clinical checks. One should make the test himself, if in any doubt of the tact and experience of the assistant or technician, and never fail to inquire into the deportment of the patient during the 12 hours preceding the test. One may find that a small cup of coffee, or a bit of toast, or a long walk has been indulged in.

The average basal metabolism of 200 cases at the beginning of treatment was +49, at the end of treatment, +16, showing a grade and constancy of reduction too uniform to be assigned to any predominating cause other than radiation treatment itself.

RECURRENCES

We had eight cases which recurred after one year, or 4 per cent. I must admit here

TABLE III — TREATMENT RESULT

| Per cent | Number | Cases studied averaging 3½ years since radiation treatment |
|----------|--------|--|
| | 200 | |
| 80.5 | 161 | Cured |
| 13.5 | 27 | Improved |
| 6 | 12 | Unimproved |
| 4 | 8 | Recurrent after one year |
| 2.5 | 5 | Went to operation |
| 0.5 | 2 | Developed myxedema |
| 0.5 | 1 | Developed telangiectasia |

TABLE IV — MISCELLANEOUS OBSERVATION IN GROUP MATERIAL OF 200 CASES

| Per cent | Number | |
|----------|--------|--|
| | 200 | Group material |
| 26 | 52 | Emphasizing focal infection factor |
| 18.5 | 37 | Emphasizing overwork as possible factor |
| 13 | 26 | Emphasizing fear and worry as possible factors |
| 9 | 18 | Emphasizing family disharmony as possible factor |
| 18.5 | 37 | Showing gastro-intestinal symptoms |
| 15 | 30 | Showing subjective heart symptoms |
| 6.5 | 13 | Showing hypertension |
| 6 | 12 | Showing severe heart damage |
| 4 | 8 | Associated with fibroid |
| 4 | 8 | Associated with marked mental symptoms |
| 3.5 | 7 | Associated with low grade fever |
| 2 | 4 | Associated with diabetes |
| 1.5 | 3 | Associated with persistent hoarseness |
| 1 | 2 | Associated with carcinoma in thyroid |

that on re-study I removed three cases from the relapse statistics because their secondary rise of symptoms occurred a few months after treatment and within the year usually allowed for cure. In these three cases, the pulse and basal rate showed the treatment was not sufficient when it was interrupted. Recurrent cases usually respond readily to a further short course of treatment.

Recurrence is a characteristic of thyroid illness (Fig 5) and should not worry the reporter of thyroid statistics. Nor should the therapist view it with unusual concern,

for a few more radiation doses will usually bring on permanent recovery.

At the Interstate Convention in October, Dr Frank Howard Lahey, of Boston, said "If my patient does not get well, I know I have not taken out enough thyroid." Thus could the radiologist say, if he wished "I failed in that case because I did not give enough treatment. The failure is not in the method of irradiation, but in my deficient technic." Our failures were 12 cases, our improved cases numbered 27, and our cures totaled 161 (Table III).

It is satisfying to feel that patients cured by radiation still have a thyroid gland left in case the body needs it for future endocrine balance. The gland has not been destroyed, but more or less inhibited according to need.

TECHNIC

Our roentgen technic has changed only in a minor degree in the last 10 years. In the usual cases the factors are 125 K V P, 36 cm F S D, 3 mm aluminum filter, 5 ma. current, one area 10×12 centimeters. The dose is repeated weekly, or at 10-day intervals, for an average of 10 doses.

The factors which are changed slightly, as the case suggests, are focal skin distance and increased fields in large goiters. The time is decreased in sick and hypersensitive cases. The spacing of treatments is extended in mild cases. The number of treatments is cut down, if improvement starts early.

In stubborn cases, we do not change the factors, but have no fear in extending the number of treatments over a period of from six to seven months.

We aim to give from a 40 to 55 per cent erythema dose. As is known, this would vary the time factor in different equipments. One should get his own so-called erythema dose by skin test and then measure the same dose in r units, so that technic may be duplicated. We have two machines which, checked by sphere gap, differ 10 per cent in kilovolt peak factory calibration.

IODINE

A few years ago in some of our cases we used iodine as an aid to roentgen therapy. The check-over showed 11 iodine cases, out of 25 studied, to have been apparently more stubborn than the expected average. We have discontinued the use of iodine, but feel

that a difference of opinion might be tenable by other workers with larger groups. Like many other goiter problems, the iodine question is still open. I suspect we have neglected other drug possibilities in our faith in roentgen therapy.

A vast number of articles (enough to equal these pages in bibliography) has been written on the consideration of thyropathies in the last five years. Of these, 156 have been examined and the titles are alphabetically appended. Clinically, sufficient proof of the value of irradiation would appear to have been established.

Thyroidectomy, as the exclusive best treatment for hyperthyroidism, is being challenged in many quarters to-day. Results claimed for it vary from 18 to 92 per cent of cures. Careful study of later post-operative results, therefore, is needed to clear up (Fig. 6) the question. Almost all of the reports in the surgical and radiologic fields, including this report, have neglected medical and neuropsychiatric consideration.

What treatment to be advised for each patient is a real medical problem—the circumstances of the patient may require a compromise.

The surgeon has a difficult decision to make. He wonders how much thyroid tissue to leave, and what is the physiologic status of this tissue which he has sewed back into place. He does not want to substitute permanent myxedema for a possible temporary hyperthyroidism. He knows that the proper subtotal will give good immediate improvement, but he wants also to know that the patient's health in years to come will be open to no serious doubt. He cannot call cured his post-operative patients with subthyroid illness.

I sympathize with the surgeon when a questionable case insists upon an operation. The surgeon knows, after operation, he has no retreat from a wrong diagnosis. I also sympathize with him when a post-operative

case returns for another radical removal, and there is *nothing*, or only a fraction of a gram, to remove. Exploration for aberrant misplaced thyroid tissue leaves him still in difficulty (Fig 7).

There are many patients who would be

understanding among physician, surgeon, and radiologist. We cannot question the conscientiousness and earnestness of one another's work. To learn the best for our patient is our aim, and this will not come through rivalry of different methods of cure,



Fig. 6 (left) A case which exhibited an unusual post-operative scar
Fig. 7 (right) A patient suffering from post-operative subthyroid illness

good material in point of courage or patience for either a surgical or roentgen treatment group, who have no positive indications or contra-indications in either direction. If one has confidence in his own method, he has a good brief for helping such a patient to decide. He has, however, neither the sporting nor ethical right to discredit another's method—little known to himself.

The object of this review has been to add, if possible, something to the general appraisal of the value of radiotherapy in the treatment of goiter illness.

Symposia on goiter should foster good

but by the collaboration and co-operation of all.

SUMMARY

We have pointed out the variation of opinion surrounding the field of goiter and its treatment. Based upon the theory of depressing a hyperactive gland function, we have shown our conviction of the value of radiation treatment. After an extended follow-up observation, 200 cases are reported. Classification of group material, treatment technic progress and final cure results are discussed. Cases averaged 10 treatments over a period of three and one-half months.

The average drop in pulse was 24.2 beats, average gain in weight, 8 pounds, and lowering in metabolic rate, 23 points.

One hundred and sixty-one cases, or 80.5 per cent, were definitely cured.

Twenty-seven cases, or 13.5 per cent, were improved, making a total of 188, or 94 per cent, either cured or improved (Table III).

Eight, or 4 per cent, recurred after one year, five of which were later re-treated and cured.

Only two cases, or 1 per cent, developed subthyroid symptoms, and only one case, or 0.5 per cent, showed telangiectases.

The importance of unhurried diagnosis and frequent metabolic rate check is emphasized.

CONCLUSION

1 Our own work as here reported has entrenched us in the conviction of the value of irradiation in goiter illness.

2 The bibliography has convinced us that thyroidectomy as the best treatment is open to serious question.

3 We feel certain that the hyperthyroid patient, as a primary problem for the internist, has been underemphasized, and that statistically much is to be desired in diagnosis and follow-up records, so that surgeon, radiologist, and internist may read and speak in the same clinical language, with better understanding, less rivalry, and more collaboration.

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Invents Tiny Apparatus to Regulate Radium Treatment—A tiny apparatus hardly larger than a pea, so small that it can be introduced into most cavities of the human body, has been devised by Dr Louis Mallet, head of the laboratory of the anti-cancer center of Tenon Hospital, Paris, to help physicians measure the amount of radiation that reaches various organs and parts of the body during radium treatment. The apparatus has been described in a report made to the French Academy of Sciences. It consists of a small metal knob, the size of a pinhead, within a slightly larger metal enclosure. The air between the two does not conduct electricity under ordinary conditions, but becomes conducting under the influence of radium. Such a tiny chamber is first screwed onto an apparatus which charges it to about 160 volts. Then

it is introduced into any part of the body, such as the throat, which is being exposed to radium. After a given time the ionizing chamber is taken out and its loss of voltage measured. This gives a measure of the intensity of radiation to which the chamber has been exposed in the body, and consequently, of the amount of radiation to which that part of the body has been exposed in the given time.

Dr Mallet is already known for his invention of a similar device which is used in many hospitals for measuring indirectly the strength of radiation employed in cancer treatment. The advantage of the new method is that one or more of the ionizing chambers can be introduced directly into the body, and that they can be sent out to be used by physicians and afterwards returned to a central laboratory for measurement.—*Science Service*

THE RADIOLOGIC ASPECT OF THYROTOXICOSIS¹

By LEON J MENVILLE, M.D., F.A.C.R., NEW ORLEANS, LOUISIANA

IN the surgical fraternity it is common to hear depreciation of the treatment of thyrotoxicosis by radiation therapy. It is said by some that, because surgery has been shown to offer a large percentage of cures with a low mortality rate, there is no need for any other method of treatment. In a few large surgical clinics of this country, excellent results have been obtained in the treatment of toxic goiter by operation, with a low mortality rate. Unfortunately, such brilliant results are not representative of those obtained by the general surgeons, who are, perhaps, competent in other fields of surgery, but lack the skill and experience so necessary in goiter surgery. Perhaps their attitude of opposition to radiation therapy would be altered if reliable statistics could be obtained on the number of cures, improvements, failures, and deaths following operation for toxic goiter by the general surgeon. If it were possible to procure such statistics, no doubt a certain number of cures and a surprisingly large number of failures and deaths would be revealed.

In one of the largest surgical clinics in America, 10,781 cases of simple toxic and exophthalmic goiter were operated on during the period from 1924 to 1930, inclusive, with a mortality rate of 1.17 per cent. This small percentage of deaths is truly remarkable and speaks well for the great skill of certain American surgeons, who, on account of their wide experience in goiter operation, have become experts. If such a low mortality rate represented the results obtained by general surgeons throughout this country, there could be but a slight argument for any other form of treatment. Unfortunately, this mortality rate does not prevail.

MacLean (1), in 1921, made a survey to ascertain the surgical mortality in exophthalmic goiter, sending questionnaires to 100 American and Canadian hospitals. The replies indicated that a mortality rate of 8 per cent existed at that time. Some time later, he sent questionnaires to 200 additional hospitals, and obtained about the same percentage, the mortality rate being then 7 per cent. In 1929, Cooke (2) stated that there was a general increase in surgical mortality rates during recent years, and that thyroid surgery headed the list, with a mortality rate which had increased 250 per cent in the preceding two decades. He believed the reason for this increase to be that every local surgeon to-day operates on goiter cases, while several years ago operation was done by only a few experts.

There are many causes which produce deaths during and following surgical operation for toxic goiter, which have been divided into immediate and post-operative causes.

The causes for immediate deaths, according to C. Mayo (3) are:

- 1 Hemorrhage
- 2 Air embolism
- 3 Myocarditis
- 4 Suffocation or the anesthetic

The causes of post-operative deaths are:

- 1 Pneumonia
- 2 Sepsis
- 3 Tetany, or myxedema

Recent animal experimental work by Nordland Hall, and St. Cyr (4) has shown that air embolism is a possible cause of sudden death during thyroidectomy. They state that "a patient with toxic goiter is much more susceptible to fatal air embolism than a patient with non-toxic goiter."

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis Nov. 30-Dec. 4, 1931.

In reviewing the causes of death during and following operation, we find that myxedema is the only one which could be produced by radiation therapy, and it is only on the rarest occasions that this occurs. No stronger argument could be advanced in favor of radiation therapy in the treatment of toxic goiter than the dangers encountered in the surgical treatment of this disease.

There was a time when gastric and duodenal ulcers were regarded as purely surgical conditions. At the present time, however, many of these ulcers are being cured by non-surgical methods. So it is with toxic goiter. For a long time the treatment was medical, then surgical. At the present time, both methods are used, and, since the addition of radiation therapy, the need for surgical operation and the mortality rate have been markedly lessened.

Radiation therapy is now considered by the better informed members of the medical profession as indispensable in the treatment of certain kinds of goiter, as is surgery in other types. Bardachzı (5) says "Roentgen therapy has become as indispensable a part of the treatment as surgery. Irradiation with a correct technic is free of danger and the mortality after operation is from 3 to 4 per cent. There is about 20 to 30 per cent recurrence after surgery and only 10 to 20 after irradiation."

The excellent results obtained in the treatment of toxic goiter by irradiation are not alone due to the changes produced in the gland when it is in a state of hyperfunction, but they are also thought to be due in a measure to the irradiation of the thymus gland. It is presently believed that the thymus gland undergoes certain changes in cases of thyrotoxicosis, and also that the benefit received in post-operative hyperthyroidism by radiation therapy is probably due, to a certain extent, to the irradiation which the thymus gland receives. Schwarz (6) recommends that the thymic region should

be included in the field of treatment while irradiating the thyroid gland, and that the larynx and trachea should be protected.

The normal thyroid gland is not considered radiosensitive by some authorities, and the effect of irradiation is manifested only when the gland is in a state of hyperfunction.

Meyer (7) concludes from animal and clinical observations "The thyroid gland belongs rather with the group of radioresistant than with the radiosensitive organs." He also states "From the viewpoint of pathology as well as from the clinical observation, an adenoma, or newgrowth of the thyroid, in which the cellular elements are increased, is more sensitive to radiation than a cystic or colloidal tumefaction." This may account for reported failures of radiation therapy in certain types of goiters. However, Holzknecht (8) states that the action of the X-rays results in inhibition or depression of the growth and function of the cells. X-radiation cures in hyperfunction and secretory hyperplasia in the same way as does surgical reduction.

Very often the statement is made that an irradiated thyroid gland becomes difficult to remove by operation because of adhesions, believed to be due to radiation therapy. Because of the lack of experimental evidence substantiating this belief, we are sometimes inclined to think this is, in many instances, simply propaganda against the use of radiation therapy in the treatment of toxic goiters. Soiland, Costolow, and Meland (9) say that reports from prominent surgeons and pathologists have discredited the belief that irradiated thyroids are more difficult to operate. They say

The general agreement is that it is impossible for the surgeon and pathologist to pick out cases which have had previous irradiation. Difficult operation is often met with in cases in which there has been previous thyroiditis.

with fibrosis, so some of the operative difficulties ascribed to radiation probably have no relation to previous irradiation. However, if the cases are properly selected for irradiation, it is very seldom that surgery will ever be needed.

In this regard, we find that Holzknecht (10) says "Only those patients suffering with Basedow's disease should be operated on who do not respond to roentgen rays, cases with large struma, compression of the trachea, or very acute cases of Basedow's disease which do not respond favorably to radiation. Following moderate doses, there are no adhesions formed to render a future operation difficult." This factor has been ruled out by statistics which prove that the adhesions, if found, were already there before the treatment and that they occurred in untreated as well as in treated cases.

We radiologists have known for many years that we have in radiation therapy a valuable agent with which to treat toxic goiters. We also recognize that the percentage of cures has been, in fact, high when compared with that of surgery, and with practically no mortality. We know that, in thyrotoxicosis, the results from radiation therapy would be greatly improved if the medical profession could be made to appreciate that the radiologist should be given the same latitude as the surgeon in treating these cases. Many radiologists have experienced the unpleasant situation of having a case of goiter referred for radiation therapy, the referring physician, at the same time, treating the patient medically, often being the one to instruct the patient when, and when not, to take radiation treatment. It would seem that the physician simply lends his patient to the radiologist. This lack of co-operation not only confuses the radiologist, who is often uninformed of the nature of this outside treatment, but offsets the good he could accomplish if the patient were kept

under his constant personal supervision. It is high time for the radiologic profession to assert itself in this regard. This can best be accomplished by educating the medical profession through presenting to it irrefutable statistics showing the high percentage of cures and improvements, with practically no mortality, when cases of thyrotoxicosis are treated by radiation therapy, and also the large number of cases treated by the radiologist which had previously been operated on. Perhaps in this manner they will be made to appreciate the great value of radiation therapy and will realize the need for closer co-operation with the radiologist.

In order to obtain such statistics, questionnaires were sent to 200 radiologists, some of whom were practising in large cities, some in small cities, and others in towns and rural districts. In this manner, we hoped to receive replies which would be representative of the results obtained by radiologists of varied experience with radiation therapy in goiter. Such statistics would be different from the usual surgical statistics which often represent the results of some skilled surgeons at a large surgical center and do not always represent the experience of the general surgeon.

At this time, 75 replies, representing 38 states, have been received. The smallest number of cases treated was 3 and the largest number was 1,500. Out of the 75 replies, 27 stated that they had either lost their records, or did not use radiation therapy in the treatment of goiter. The replies indicated that the method of distribution was very fair and should make this report an interesting one for statistical study.

In order to facilitate the study of the replies received, we have grouped them in eight classes, including one table. A study of the various divisions discloses some interesting data. Groups 1 and 3, with the smallest number of cases (63 and 328 respectively), show the lowest percentage

| UNITED STATES | 1 Percentage of cures | 2 Percentage showing marked improve- ment | 3 Percentage of recur- rences | 4 Percentage of failures | 5 Percentage treated after operation | 6 No of cases in which surgery failed | 7 Total number of cases |
|---------------|--|--|--|-----------------------------------|--|--|----------------------------------|
| Arkansas | 60.0 | 20.0 | 0 | 20.0 | 0 | 0 | 20 |
| Arkansas | 54.0 | 24.0 | 0 | 12.0 | 18.0 | 2.8 | 16 |
| California | No records but all patients treated were benefited | | | | | | |
| California | 50.0 | 43.0 | 5.0 | 7.0 | 10.0 | 36.0 | 360 |
| California | 73.0 | 16.0 | -- | 11.0 | 3.0 | 22.5 | 750 |
| California | Do not treat | | | | | | |
| California | 70.0 | 0 | 0 | 30.0 | 10.0 | 15.0 | 150 |
| Colorado | 64.7 | 35.3 | 26.4 | 0 | 17.6 | 22.8 | 130 |
| Colorado | 50.0 | 50.0 | 0 | 0 | -- | 6 | |
| Colorado | 65.0 | 20.0 | 26.0 | 15.0 | 17.0 | 6.0 | 34 |
| Connecticut | 21.8 | 69.9 | 7.1 | 8.3 | 1.0 | 0.6 | 60 |
| Delaware | Do only diagnostic work | | | | | | |
| D C (Wash) | 85.0 | 0 | 10.0 | 15.0 | 20.0 | 60.0 | 300 |
| D C (Wash) | 88.85 | 8.52 | 1.31 | 2.63 | 8.5 | 25.92 | 305 |
| Florida | 90.0 | 5.0 | 0 | 5.0 | 0 | 0 | 50 |
| Florida | Do not treat | | | | | | |
| Georgia | -- | -- | 10.0 | -- | 3.0 | 0.96 | 32 |
| Georgia | 94.0 | 6.0 | 0 | 0 | 12.0 | 4.2 | 35 |
| Illinois | 70.32 | 23.0 | 3.0 | 7.0 | 2.0 | 3.34 | 167 |
| Illinois | 70.0 | 25.49 | 4.5 | 4.29 | 7.0 | 40.8 | 583 |
| Illinois | 60.0 | 40.0 | -- | 0 | -- | 50 | |
| Illinois | Not treating | | | | | | |
| Illinois | 30.0 | 20.0 | 10.0 | 50.0 | 5.0 | 5.5 | 110 |
| Illinois | 80.0 | 15.0 | 10.0 | 5.0 | 9.8 | 100.0 | 1,020 |
| Illinois | 67.0 | 17.0 | 5.0 | 16.0 | 20.0 | 100.0 | 500 |
| Illinois | 80.0 | 4.0 | 12.0 | 16.0 | 10.0 | 38.5 | 385 |
| Indiana | No records | | | | | | |
| Iowa | 80.0 | 15.0 | 10.0 | 5.0 | 50.0 | 35.0 | 70 |
| Iowa | 25.0 | 50.0 | -- | 25.0 | -- | -- | |
| Iowa | Do not treat | | | | | | |
| Kansas | 60.0 | 25.0 | 15.0 | 15.0 | 25.0 | 9.25 | 37 |
| Kansas | 85.0 | 5.0 | 15.0 | 10.0 | 20.0 | 40.0 | 200 |
| Kentucky | 85.0 | 15.0 | -- | 0 | 2.0 | 4.0 | 200 |
| Louisiana | 72.0 | 22.0 | 2.0 | 6.0 | 2.0 | 2.0 | 103 |
| Louisiana | 70.0 | 28.5 | -- | 1.5 | 2.0 | 5.5 | 275 |
| Maine | Do not treat | | | | | | |
| Maryland | Do not treat | | | | | | |
| Maryland | No record | | | | | | |
| Massachusetts | 72.0 | 0 | 27.0 | 27.0 | 0 | 0 | 18 |
| Michigan | Do not treat. | | | | | | |
| Michigan | Do not treat. | | | | | | |
| Minnesota | 95.0 | 0 | 0 | 5.0 | 10.0 | 40.0 | 400 |
| Minnesota | Do not treat | | | | | | |
| Minnesota | Do not treat. | | | | | | |
| Mississippi | No records | | | | | | |
| Missouri | No records | | | | | | |
| Nebraska | 70.0 | 10.0 | 7.0 | 20.0 | 10.0 | 14.0 | 140 |
| Nebraska | 75.0 | 20.0 | 33.33 | 5.0 | 18.0 | 54.0 | 300 |
| New Jersey | 90.0 | 4.44 | -- | 5.56 | -- | -- | |
| New Jersey | 73.0 | 21.0 | 5.0 | 6.0 | 0 | 0 | 270 |
| New York | 66.0 | 16.0 | 0 | 18.0 | -- | -- | |
| New York | Do not treat | | | | | | |
| New York | Do not treat | | | | | | |
| New York | 33.3 | 33.3 | -- | 33.3 | 0 | 0 | |
| New York | 19.44 | 47.23 | 4.17 | 33.33 | 30.55 | 11.0 | 100 |
| North Dakota | 32.0 | 45.0 | -- | 23.0 | 16.0 | 4.8 | 36 |
| North Dakota | Do not treat | | | | | | |
| Ohio | Do not treat | | | | | | |
| Oregon | Do not treat | | | | | | |
| Pennsylvania | 86.0 | 14.0 | 2.6 | 0 | 12.0 | 63.8 | 532 |
| Pennsylvania | 87.5 | 8.0 | -- | 4.5 | 8.0 | 32.0 | 400 |
| Rhode Island | 40.0 | 15.0 | 25.0 | 45.0 | 5.0 | 7.6 | 153 |
| South Dakota | Do not treat | | | | | | |
| Texas | 24.0 | 60.0 | 4.0 | 16.0 | 8.0 | 2.0 | 25 |
| Texas | 95.0 | 0 | 10.0 | 5.0 | 1.0 | 0.2 | 21 |

(Continued on next page)

| UNITED STATES | 1 Percentage of cures | 2 Percentage showing marked improvement | 3 Percentage of recurrences | 4 Percentage of failures | 5 Percentage treated after operation | 6 No of cases in which surgery failed | 7 Total number of cases |
|------------------|--------------------------|--|--------------------------------|-----------------------------|---|--|----------------------------|
| Utah ----- | 50.0 | 40.0 | --- | 100 | 75 | 10.5 | 141 |
| Vermont ----- | Do not treat | | | | | | |
| Virginia ----- | No record | | | | | | |
| Washington ----- | Do not treat. | | | | | | |
| Washington ----- | Do not treat | | | | | | |
| Wisconsin ----- | 100.0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Wisconsin ----- | Do not treat | | | | | | |
| CANADA | | | | | | | |
| Alberta ----- | 60.0 | 20.0 | 15.0 | 20.0 | 30 | 3.2 | 108 |
| Ontario ----- | 77.5 | 12.5 | 7.5 | 10.0 | 100 | 150.0 | 1,500 |
| Totals ----- | 3,046.41 (46) | 969.18 (46) | 312.91 (37) | 573.41 (46) | 427.95 (43) | 979.93 (43) | 10,541 (47) |
| Averages ----- | 66.22 | 21.07 | 8.45 | 12.4 | 9.95 | 22.78 | 224.27 |

SUMMARY OF GENERAL AVERAGES

75 replies
(35, United States, 1, Washington, D. C.,
2 Canada)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---------------------|---------------------------------------|---------------------------|------------------------|------------------------------------|---|-----------------------|--------------|------------|
| Percentage of cures | Percentage showing marked improvement | Percentage of recurrences | Percentage of failures | Percentage treated after operation | Number of cases in which surgery failed | Total number of cases | Do not treat | No records |
| 66.22 | 21.07 | 8.45 | 12.4 | 9.95 | 979.93 | 10,541 | 21 28% | 6 8% |

of cures, whereas Group 8, with the largest number of cases (3,270), shows the highest percentage of cures. However, the average of all the groups is high.

Out of a total of 10,541 cases treated by radiation therapy, 980 had previously been operated on. The percentage of recurrences is low and should compare favorably with that of surgery. In fact, a superficial search of the medical literature indicates that recurrences after surgery are placed by some at from 20 to 30 per cent, however, in this series of 10,541 irradiated cases, it was only 8.45 per cent.

It must be concluded from this statistical study that radiation therapy is a safe form of treatment in thyrotoxicosis and the percentage of cases is comparable with that of surgery, the recurrences being perhaps less. This survey clearly shows that radiologists

are capable of satisfactorily treating cases of thyrotoxicosis, and that the splendid results obtained with radiation therapy are not restricted to a few radiologists of great experience but are general among the radiologists of this country.

It should, therefore, be appreciated that radiation therapy at the present time offers more to certain goiter patients than any other form or forms of treatment. Myxedema is the only one of the many immediate and post-operative causes of death to such patients when operated on which can be produced by excessive radiation therapy, and this happens only occasionally. For this reason, radiation therapy is the safest of any single method of treatment. It offers as high a percentage of cures, with less percentage of recurrence, and its economic consideration is of importance. Patients are

SUMMARY BY GROUPS

GROUP I
(5-20 Cases)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------------|---------------------------------------|---------------------------|------------------------|------------------------------------|---|-----------------------|
| Percentage of cures | Percentage showing marked improvement | Percentage of recurrences | Percentage of failures | Percentage treated after operation | Number of cases in which surgery failed | Total number of cases |
| 25 | 50 | — | 25 | — | — | — |
| 50 | 50 | 0 | 0 | 0 | 0 | 6 |
| 60 | 20 | 0 | 20 | 0 | 0 | 20 |
| 100 | 0 | 0 | 0 | 0 | 0 | 3 |
| 54 | 24 | 0 | 12 | 18 | 28 | 16 |
| 72 | 0 | 27 | 27 | 0 | 0 | 18 |
| <u>361</u> | <u>144</u> | <u>27</u> | <u>84</u> | <u>18</u> | <u>28</u> | <u>63</u> |
| <u>60.1</u> | <u>24</u> | <u>5.4</u> | <u>14</u> | <u>3.6</u> | <u>5.6</u> | <u>12.6</u> |
| (Averages) | | | | | | |

GROUP II
(20-50 Cases)

| | | | | | | |
|---------------|---------------|--------------|---------------|---------------|--------------|-------------|
| 90 | 5 | 0 | 5 | 0 | 0 | 50 |
| 94 | 6 | 0 | 0 | 12 | 0.96 | 32 |
| 60 | 40 | — | 0 | 0 | 0 | 50 |
| 60 | 25 | 15 | 15 | 25 | 9.25 | 37 |
| 32 | 45 | — | 23 | 14 | 6.16 | 44 |
| 73 | 21 | 5 | 6 | 16 | 4.8 | 30 |
| 95 | 0 | 10 | 5 | 0 | 0 | 44 |
| 65 | 20 | 26 | 15 | 17 | 0.2 | 21 |
| 19.44 | 47.23 | 4.17 | 33.33 | 30.55 | 6.0 | 34 |
| 24 | 60 | 40 | 16.0 | 8 | 11.0 | 36 |
| <u>612.44</u> | <u>269.23</u> | <u>74.17</u> | <u>118.33</u> | <u>126.55</u> | <u>44.57</u> | <u>438</u> |
| <u>61.24</u> | <u>26.92</u> | <u>8.24</u> | <u>11.83</u> | <u>10.54</u> | <u>3.71</u> | <u>36.5</u> |
| (Averages) | | | | | | |

GROUP III
(50-100 Cases)

| | | | | | | |
|--------------|--------------|-------------|--------------|-------------|-------------|------------|
| 55.0 | 43.0 | 20 | 20 | 10 | 9.8 | 98 |
| 33.3 | 33.3 | — | 33.3 | 0 | 0 | 100 |
| 80.0 | 15.0 | 10.0 | 5.0 | 50 | 35.0 | 70 |
| 21.8 | 69.9 | 71 | 8.3 | 10 | 0.6 | 60 |
| <u>190.1</u> | <u>161.2</u> | <u>19.1</u> | <u>48.6</u> | <u>70</u> | <u>45.4</u> | <u>328</u> |
| <u>47.5</u> | <u>40.3</u> | <u>6.3</u> | <u>12.15</u> | <u>17.5</u> | <u>11.3</u> | <u>82</u> |
| (Averages) | | | | | | |

GROUP IV
(100-200 Cases)

| | | | | | | |
|--------------|--------------|--------------|--------------|-------------|---------------|--------------|
| 64.7 | 35.3 | 26.4 | 0 | 17.6 | 22.8 | 130 |
| 70.0 | 0 | 0 | 30.0 | 100 | 15.0 | 150 |
| 70.0 | 23.0 | 30 | 7.0 | 20 | 3.54 | 167 |
| 30.0 | 20.0 | 10.0 | 50.0 | 50 | 5.5 | 110 |
| 85.0 | 15.0 | — | 0 | 20 | 4.0 | 200 |
| 70.0 | 10.0 | 7.0 | 20.0 | 100 | 14.0 | 140 |
| 85.0 | 5.0 | 15.0 | 10.0 | 200 | 40.0 | 200 |
| 72.0 | 22.0 | 2.0 | 6.0 | 20 | 20 | 103 |
| 40.0 | 15.0 | 25.0 | 45.0 | 50 | 7.6 | 153 |
| 50.0 | 40.0 | — | 10.0 | 7.5 | 10.5 | 141 |
| 60.0 | 20.0 | 15.0 | 20.0 | 3.0 | 3.2 | 108 |
| <u>696.7</u> | <u>205.3</u> | <u>103.4</u> | <u>198.0</u> | <u>84.1</u> | <u>128.14</u> | <u>1,602</u> |
| <u>63.3</u> | <u>18.6</u> | <u>11.4</u> | <u>18.0</u> | <u>7.6</u> | <u>11.63</u> | <u>145.6</u> |
| (Averages) | | | | | | |

(Continued on next page)

GROUP V
(200-300 Cases)

| 1 Percentage of cures | 2 Percentage showing marked improve- ment | 3 Percentage of recur- rences | 4 Percentage of failures | 5 Percentage treated after operation | 6 Number of cases in which surgery failed | 7 Total number of cases |
|-----------------------------|--|--|--------------------------------|--|--|-------------------------------|
| 85 | 0 | 10 | 15 | 20 | 60 | 300 |
| 75 | 20 | 33.3 | 5 | 18 | 54 | 300 |
| 90 | 44 | — | 5.56 | — | — | 270 |
| 70 | 28.5 | — | 15 | 2 | 55 | 275 |
| <u>320</u> | <u>52.94</u> | <u>43.3</u> | <u>27.06</u> | <u>40</u> | <u>119.5</u> | <u>1,145</u> |
| <u>80</u> | <u>13.23</u> | <u>21.6</u> | <u>6.74</u> | <u>13.3</u> | <u>39.8</u> | <u>286.2</u> (Averages) |

GROUP VI
(300-400 Cases)

| | | | | | | |
|--------------|--------------|--------------|--------------|-------------|---------------|-----------------------|
| 88.5 | 8.52 | 1.31 | 2.63 | 8.5 | 25.92 | 305 |
| 66.0 | 16.0 | — | 18.0 | — | — | 328 |
| 50.0 | 43.0 | 5.0 | 7.0 | 10.0 | 36.0 | 360 |
| 80.0 | 4.0 | 12.0 | 16.0 | 10.0 | 38.5 | 385 |
| 95.0 | 0 | 0 | 5.0 | 10.0 | 30.0 | 300 |
| 87.5 | 8.0 | — | 4.5 | 8.0 | 32.0 | 400 |
| <u>467.0</u> | <u>79.52</u> | <u>18.31</u> | <u>53.13</u> | <u>46.5</u> | <u>172.42</u> | <u>2,178</u> |
| <u>77.8</u> | <u>13.25</u> | <u>4.77</u> | <u>8.85</u> | <u>9.3</u> | <u>34.48</u> | <u>363</u> (Averages) |

GROUP VII
(400-600 Cases)

| | | | | | | |
|---------------|--------------|-------------|--------------|-------------|--------------|-----------------------|
| 70.32 | 25.49 | 4.5 | 4.29 | 7.0 | 40.8 | 583 |
| 86.0 | 14.0 | 2.6 | 0 | 12.0 | 63.8 | 532 |
| 67.0 | 17.0 | 5.0 | 16.0 | 20.0 | 100.0 | 500 |
| <u>223.32</u> | <u>56.49</u> | <u>12.1</u> | <u>20.29</u> | <u>39.0</u> | <u>204.6</u> | <u>1,615</u> |
| <u>74.44</u> | <u>18.83</u> | <u>4.0</u> | <u>6.76</u> | <u>13.0</u> | <u>68.2</u> | <u>538</u> (Averages) |

GROUP VIII
(600-1,500 Cases)

| | | | | | | |
|--------------|-------------|-------------|------------|-------------|--------------|-----------------------|
| 73.0 | 16.0 | 0 | 11 | 3 | 22.5 | 750 |
| 80.0 | 15.0 | 10.0 | 5 | 9.8 | 100.0 | 1,020 |
| 77.5 | 12.5 | 7.5 | 10 | 10.0 | 150.0 | 1,500 |
| <u>230.5</u> | <u>43.5</u> | <u>17.5</u> | <u>26</u> | <u>22.8</u> | <u>272.5</u> | <u>3,270</u> |
| <u>76.8</u> | <u>14.5</u> | <u>5.8</u> | <u>8.6</u> | <u>7.6</u> | <u>90.8</u> | <u>1,090</u> (Totals) |

relieved of hospitalization, with its attending expense, along with the mental anguish of an approaching operation. Then, again, should operation be deemed imperative, after irradiation, there can be no contra-indication to such a procedure. But if care is exercised in selecting goiter cases for irradiation, there will seldom be need for operative interference. We believe from general observation that there is indication for the use of surgery in certain types of goiter, we are

also convinced that, if radiation therapy were used whenever it is indicated, many lives would be saved and a very large percentage of such cases cured.

This report is a convincing demonstration of the fatuity of the notion existing among certain members of the medical profession, that radiation therapy will allow itself to be overlooked in the treatment of certain types of goiter. On the contrary, we have irrefutable proofs of its efficacy in the treat-

ment of thyrotoxicosis, and we are hopeful that the medical profession will soon realize its merits in a more general way

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Measurement of Electron Rays is Improved

The methods of measuring the powerful Lenard or electron rays have been perfected by an investigation of Dr Lauriston S Taylor, of the United States Bureau of Standards

Lenard rays are obtained by pushing electrons through a vacuum tube under a pressure of several hundred thousand volts. By use of a small window of metal or glass the speeding electrons can be obtained in the air outside of the tube. As they have been used, since their first production in large quantities by Dr W D Coolidge, for a great variety of chemical and biological purposes it is important to have an accurate method of measuring them.

Three methods of measuring the rays were compared. Of these the use of a "Faraday

chamber" was found to be most effective. This consists of two metal chambers enclosed one within the other and having openings through which the electrons may pass to the inner chamber.

The alternative methods are by means of an open plate or by means of a condenser. The open plate results were too low, but always in a constant ratio to the Faraday chamber measurements. The condenser method gave results that did not agree with the Faraday chamber results.

The difficulty of making this measurement lies in the fact that the swift electrons striking a metal surface set free other electrons so that the total amount of electricity cannot easily be obtained.—*Science Service*

THE RADIUM TREATMENT OF TOXIC TYPES OF GOITER¹

By D T QUIGLEY, M.D., F.A.C.S., OMAHA, NEBRASKA

THE difference between the types of goiter amenable to radiation treatment and all other types lies in the fact that those in which radiation has proven to be of value are the types accompanied by an increased functional cell activity. In most of these cases there is also a proliferation of cells. Therefore, the problem presented is the problem of reducing the amount of secreting epithelial surface, whether it be contained in an adenoma or in a thyroid hyperplasia. We have also the problem of reducing the degree of hyperactivity of individual cells.

There is an optimum point in thyroid secretion. Departure from this point, either upward or downward, leads to disease. While a small increase in thyroid secretion heightens all the vital powers and functions, a greater degree of increase has a profoundly poisonous effect on all body structures, these effects being particularly noticeable in the nervous system, the brain, and the glands of internal secretion.

In dealing with hypothyroidism or hyperthyroidism, we are dealing simply with a departure from normal quantity in the secretion of the thyroid, the departure being either a lack of the necessary secretion, or an over-supply of the same secretion.

In dealing with adenoma of the thyroid, we have introduced into the equation quite a different factor. We have here to deal with an increased activity of thyroid tissue, but the thyroid tissue in question is not normal. It is a more or less abnormal structure growing inside of a capsule, which in turn, is inside of a thyroid gland. The tumor tissue produces a secretion which is incomplete, or otherwise abnormal in its

manufacture. To a certain degree, it imitates normal thyroid secretion, but it exerts a more poisonous effect owing to the fact that it is not only excessive in amount, but it is also abnormal in chemical make-up. We have here to deal with a question of quality as well as quantity.

In dealing with toxic thyroid, we are dealing with both increased proliferation of cells and increased activity of these cells. Such physiologic behavior suggests an irritating factor in the etiology of the disease, the search for which has been going on for many years. The knowledge now at hand, the most reasonable working hypothesis, is that micro-organisms brought into the gland through the blood, or lymph vessels, and acting directly on the thyroid epithelium are the principal etiologic factors. It is possible that the overgrowth of thyroid tissue may, in some degree, be compensatory. Thyroid secretion combats toxins and infections. An abnormally high amount of material, emanating from foci of low-grade infection, may call out an extra effort on the part of the thyroid infection-fighting mechanism and this, in order to protect the body as a whole, may lead to the overgrowth of the secreting epithelium which has this protective effect. If this theory is correct, then radiation is the treatment of choice because it has the effect of inhibiting or, in larger doses, actually killing the hyperactive and hyperproliferating cells, and also of killing certain low-grade infections. Except in extreme cases, surgical removal of the offending exophthalmic goiter would then be contra-indicated. On this same theory, the surgical removal of thyroid adenoma would be indicated owing to the fact that the secretion here is poisonous, even in small amounts.

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting at St Louis, Missouri Nov 30-Dec. 4 1931

A factor which must be considered in all goiter work is iodine supply. The secretion elaborated by the thyroid contains iodine. In the absence of sufficient quantities of iodine, the thyroid enlarges in order that a greater number of cells may be put to work to recover iodine from the circulating blood.

The relation between iodine content in food and goiter is well known. The countries in which the soil, and, therefore, the vegetables, are deficient in iodine always carry a high goiter incidence. Those in which iodine is plentiful have relatively few cases of goiter. An example of the latter is the State of South Carolina, which has the highest iodine content in the soil and, therefore, the highest iodine content in the vegetables produced. This State has the lowest goiter incidence.

Goiter is common in valleys which receive little sunshine, such as the narrow valleys in the Swiss Alps. The same thing is true of the mountain valleys in Montana and Wyoming.

Districts in which cistern water is used, instead of well water, have a high goiter incidence. Cistern water contains large numbers of colon bacilli from the deposits made by birds on the roofs of houses. On the prairies of the Dakotas, Minnesota, Michigan, and Wisconsin, we find abundant sunshine, but a deficiency in iodine. These areas produce many cases of goiter. But the goiter incidence is markedly increased here in the districts in which cistern water is used, for, in addition to the patient's experiencing iodine starvation, the upper part of the alimentary canal is exposed to colon bacilli.

We find, then, three factors contributing directly to goiter incidence: (1) iodine starvation, (2) lowered resistance to infections in general on account of deficiencies in food and sunshine, (3) exposure of the upper part of the alimentary tract to water containing colon bacilli.

The toxic types of goiter are, undoubtedly, more common than is generally supposed. Many of these present no tumor mass and are due to an excessive activity, or some little tumor mass is present, but is concealed in the upper part of the chest or behind the sternum. In over-fat persons, it is very easy to fail to discover enlargements, even of normally placed thyroids. These may be located, however, by means of the X-ray.

Toxic conditions of the thyroid are usually accompanied by a high degree of irritability of the nervous system. The patient is nervous, his hands are shaky, and, while he eats large quantities of food, his muscular strength is decreased. His eyes may or may not become more prominent and he may exhibit many symptoms which border on insanity. The whole symptom complex goes through periods of exacerbation followed by periods of quiescence. Each flare-up of symptoms, however, usually becomes a little more severe than the one preceding it. In the later stages of the disease there are no remissions and the symptom complex constantly increases in severity, until death by heart failure occurs.

The action on the heart is, perhaps, the most important effect produced by toxic goiter. It is well known that, in the mortality records, heart disease leads all others by a good margin as a cause of death. It is problematical how much of this mortality may truthfully be attributed to disturbances of the thyroid gland. There is no question but that many diseases diagnosed by physicians as various forms of primary heart disease are, in reality, secondary effects upon the heart produced by thyroid disease. A more general use of basal metabolism tests would uncover the truth in a large number of these cases; however, basal metabolism tests will not completely clear the situation. X-ray films to discover hidden goiters, a more careful examination of patients, and better co-ordination of symptoms and signs

THE RADIUM TREATMENT OF TOXIC TYPES OF GOITER¹

By D T QUIGLEY, M D, F A C S, OMAHA, NEBRASKA

THE difference between the types of goiter amenable to radiation treatment and all other types lies in the fact that those in which radiation has proven to be of value are the types accompanied by an increased functional cell activity. In most of these cases there is also a proliferation of cells. Therefore, the problem presented is the problem of reducing the amount of secreting epithelial surface, whether it be contained in an adenoma or in a thyroid hyperplasia. We have also the problem of reducing the degree of hyperactivity of individual cells.

There is an optimum point in thyroid secretion. Departure from this point, either upward or downward, leads to disease. While a small increase in thyroid secretion heightens all the vital powers and functions, a greater degree of increase has a profoundly poisonous effect on all body structures, these effects being particularly noticeable in the nervous system, the brain, and the glands of internal secretion.

In dealing with hypothyroidism or hyperthyroidism, we are dealing simply with a departure from normal quantity in the secretion of the thyroid, the departure being either a lack of the necessary secretion, or an over-supply of the same secretion.

In dealing with adenoma of the thyroid, we have introduced into the equation quite a different factor. We have here to deal with an increased activity of thyroid tissue, but the thyroid tissue in question is not normal. It is a more or less abnormal structure growing inside of a capsule, which, in turn, is inside of a thyroid gland. The tumor tissue produces a secretion which is incomplete, or otherwise abnormal in its

manufacture. To a certain degree, it imitates normal thyroid secretion, but it exerts a more poisonous effect owing to the fact that it is not only excessive in amount, but it is also abnormal in chemical make-up. We have here to deal with a question of quality as well as quantity.

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must be the rule if the thyroid hearts are to be separated from other forms of heart disease. If the large number of thyroid hearts which operate as causes of death are removed from the list of heart diseases and placed in the category of thyroid disease, where they belong, not only would the mortality records show an improvement in the situation as regards heart disease, but also many cures might be effected in these cases of thyroid disease. Thus the mortality records in both heart and thyroid diseases might be very much bettered.

In exophthalmic goiter, the ideal therapy is that which directly reduces the number of proliferating secreting cells and reduces the activity of the cells which remain. If this therapy also carries a direct killing effect on low-grade micro-organisms, then it leaves little to be desired except the clearing out of foci of infection which may be feeding micro-organisms into the diseased thyroid.

In the surgical treatment of the disease, nothing is accomplished except the mechanical removal of the over-secreting and hyperplastic mass of cells. The area of thyroid tissue which remains after a surgical operation is likely to go through the same kind of hyperplasia again, because the cause of the disease has not been removed. Clinically, the truth of this is shown far too often and we occasionally see cases in which exophthalmic goiter has recurred many times.

CASE REPORTS

In 1916, the author treated his first patient with radium—a woman who had already submitted to three operations for recurring exophthalmic goiter. Following the last operation, the goiter had, in a period of three months, recurred to its original size and severity. A dose of 150 mg was administered over the enlarged thyroid in three 3-hour treatments, the treated area be-

ing changed so that the whole area was evenly irradiated. After waiting a period of three months, in which time the patient showed definite signs of improvement, the treatment was repeated. It was again repeated after another three-months period. The size of the enlarged gland was very materially reduced, the symptoms disappeared, the prominent eyes became somewhat less prominent and, since the time that this treatment was given, the patient has been well.

During the same year, a patient was treated who was considered to be in a dying condition from heart disease. She was 24 years of age and had a history of having been ill with heart symptoms, rapid pulse, and muscular weakness for several months. She had been confined to bed for four and a half months. She had consumed quantities of digitalis and other heart medicines. The woman was very much emaciated, exceedingly nervous, and mentally in a condition approaching mania. As she lay in bed, it was noticed that she had a rather prominent swelling in the region of her thyroid and I suggested the application of 60 mg of radium heavily screened over the swollen thyroid. The application was made for a period of 13 hours. Three weeks later the patient was much improved. Her pulse, which had been so rapid that it could not be counted, had come down to 120. Her muscular strength was so much better that she sat up in bed. Her mental condition was clearer. At this time another application of 60 mg of radium was applied for 13 hours. Three weeks after the second application the patient was able to be up in a chair, and from that time on her progress was continuous. After three months, she was given another treatment. At this time she expressed a desire to resume her occupation as school teacher, but she was advised to rest for one year. During this year she was married. Now, 15 years have

elapsed since her treatment. During these years she has had no recurrence, although she has experienced very severe mental strain. Her husband, a banker, was imprisoned for two years following the failure of his bank. The patient went through these periods of strains and stresses and is now back at her old occupation, teaching school, without any recurrence of her hyperthyroid symptoms.

In 1917, during the war hysteria, a farmer's wife presented herself with all the symptoms of an advanced exophthalmic goiter. Her troubles were accentuated by war conditions. She was obliged to take care of five small children, the animals about the farm, do the milking, the churning, and other necessary duties. Her position was almost intolerable. She was kept in the hospital three days and 120 mg of radium applied separately over each lobe of the thyroid and the isthmus. She was instructed to rest three months, no matter what the cost might be, as her weakened heart could not possibly withstand a continuation of the strains to which it had been subjected. Four months later she returned, apparently well, and having gained several pounds in weight. I suggested to her that the rest had probably been the principal factor in her recovery. She replied that she had taken no rest, and, not having been able to secure help for either the farm or the house, had carried on her work exactly as before her treatment. The improved condition could be attributed to nothing but the radium treatment. As there were some nervous symptoms and rapidity of pulse still apparent, she was given another treatment, remaining in the hospital a day and a half. We did not see this patient again until four years later, when she came to the city. As she had remained well, no other treatment was used except the removal of two crowned dead teeth which we presumed might have had some etiologic relationship to the goiter.

In 1918, a woman, 45 years of age, came from a small town in South Dakota where cistern water was used for drinking purposes. The well water in this neighborhood was contaminated with more or less iron which gave it a bitter taste, and, on drying, produced a red precipitate. This sediment convinced the inhabitants that the well water was unwholesome. The woman had a moderately enlarged thyroid gland with all the signs and symptoms of exophthalmic goiter. Her thyroid was irradiated and an infected maxillary sinus drained. This, with a three-day stay in the hospital, started her on the road to recovery and in three months her symptoms were entirely cleared up. She has remained well since then. She was instructed to discontinue the use of cistern water.

In the latter part of October, 1920, a post-office employee, 40 years of age, was referred by an Omaha physician for treatment for exophthalmic goiter. The thyroid was very much enlarged, presenting a mass like a collar encircling both sides and the front of his neck. His pulse was 140. He had applied for relief to his physician, because he had found that his muscular strength was failing to such an extent that he could hardly continue with his work—loading heavy mail sacks on to trucks. This patient was extremely nervous and shaky. Owing to the fact that he had a large family and a small income, he felt that he could not afford to give up his work and enter the hospital for an operation. He was given a radium treatment which consisted of the application of 120 mg of radium, screened with 1 mm of silver and 1 mm of brass at a distance of 2 cm, for 20 hours over each lobe and for the same length of time over the isthmus. After six weeks this was repeated, but with half the amount of radium used in the first treatment. The patient who kept on with his work received no other treatment except that two

badly diseased teeth were removed. During the months of November and December, his work increased very materially on account of the Christmas rush, but during this time he was able to continue without intermission. It was felt at the time that the situation, putting an extra strain on his heart muscle as it did, would lead to a permanently damaged heart, however, nothing of this kind has developed. The patient has kept on at the same work during the 11 years intervening and at the present time is apparently well.

In my experience, favorable results, which may be comparable with results obtained by surgical operation have been obtained in approximately 70 per cent of the cases treated. We have found that the cases which do not respond well to treatment by surgical operation and that recur after surgical operation usually respond well to radium radiation. On the other hand, cases which fail to show good results following radium treatment are usually good cases for surgery. I do not know of a case that has been properly treated with radium radiation, even though the radium radiation has been unsuccessful in controlling the symptoms, that has recurred following a subsequent surgical operation. Apparently the radium radiation reduces the likelihood of recurrence, or prevents it altogether. Radium treatment, then, helps to make surgery more efficient in this particular class of cases. In those unsuccessfully treated cases that have been followed to the operating room, there has been no increase in the difficulties incident to the removal of the goiter. No adhesions have been noticed in any case, but in many of the diseased glands that have been subjected to radium treatment an increased hardness has been noticed, due to the production of considerable amounts of connective tissue. The firmness and hardness which occur in some of these irradiated glands probably make it easier for the

surgeon to remove the diseased tissue, because it does not collapse under his fingers like ordinary thyroid tissue.

During the period between 1915 and 1927 we have treated 137 cases. No account is taken of cases since 1927, as we believe that sufficient time has not elapsed in the latter to justify recording the results at this time. This group contains 18 patients treated as charity patients and in the University Hospital and 119 treated in private practice. Of the University Hospital and charity patients, 12 were subsequently recommended for surgical operation. Only five responded successfully to the radium treatment. One left the hospital without completing the treatment. Of the cases treated in private practice during the same time period, 83 were sufficiently improved so that subsequent surgical intervention has not been necessary, 35 have shown little or no improvement and have been referred for surgery. Some of these patients have since died from other diseases, some have been lost, and some have had satisfactory results from surgical operations. In the cases successfully treated with radium are 15 who had previously been operated upon, but in whom there had been one or more recurrences.

It will be noted that, in the University Hospital and charity patients, the percentage of satisfactory results was much less than among private patients. This may be accounted for by the fact that the University Hospital patients are generally paupers, poorly fed and poorly housed, it being impossible for them to secure good living conditions after they have left the hospital. The private patients, on the other hand, were well fed, well housed, and did not have to suffer from the mental stresses and strains incident to pauperism, on leaving the hospital, they went back to good homes and good food.

In the cases that show satisfactory results after radium treatment, the first symptoms

to show improvement are those of nervous origin. The patient's extreme nervous irritability becomes markedly lessened, usually within the first three days. Muscular strength is noticeably increased within the first week. Mental excitability is much improved after the first five or six days. The patient who has been on the verge of mania will appear calm and placid after two or three weeks. There is usually considerable reduction in the size of the thyroid gland. In some cases the gland has been reduced apparently to normal size. In many, the reduction in size is only partial. This, of course, is not satisfactory to the patient who wishes all objective evidences of the disease removed. The same thing may be said about the undue prominence of the eyes. In some cases, the eyes recover the normal appearance. Most maintain a certain degree of prominence of the eyes even after all other signs and symptoms of the disease have disappeared. Usually, however, it is lessened, but not completely reduced to normal. The diarrhea which accompanies some cases of goiter is usually improved early and the patient's ability to digest food is better. These patients are nearly all below normal weight. With an increased ability to digest food and a lessened oxidation the weight increases. In no cases have I seen myxedema follow radium treatment. Apparently complete destruction of thyroid tissue is not possible with radium as long as the metal screening and the distance are correctly estimated and the dose is kept within reasonable limits.

In regard to toxic adenoma, the results with radium have not been so satisfactory as with exophthalmic goiter. The percentage of cases requiring subsequent operation is approximately 50. The cases of adenoma that respond show the beneficial effect very quickly, so that, if it is desired to use the therapeutic test on such a patient, ten days or two weeks will show whether it is better

treated by radium radiation or surgery. In such cases, no skin burn which might interfere with surgical operation need be produced.

It is probable that in some cases there also exists, in some degree, coincident disease involving the parathyroids. In no case in our group has any injurious action on the parathyroids been noted. This fact should be considered in connection with the possibility of accidental removal of the parathyroid, which sometimes occurs during surgical operation.

The destructive action of radium radiation on the diseased tissues seems to be present in both toxic adenoma and exophthalmic goiter. The percentage of actual cures is much higher in exophthalmic goiter because here we are simply inhibiting excessive activity. In adenomas, the actual destruction of tumor tissue by the radiation is necessary. In both adenomatous and exophthalmic goiter cases we occasionally perceive unusual symptoms which seem to indicate that both hypothyroidism and hyperthyroidism are present. Even in these cases the radium radiation seems to help to restore normal balance. This is probably due to the fact that the radiation kills low-grade infecting organisms of different types, some of which are stimulating and some of which are inhibiting to the particular epithelium in which they happen to lodge. Thyroid secretion is, undoubtedly, a complex product that may carry simultaneously certain potent elements in hyper- and others in hypo-quantities.

Some cases of exophthalmic goiter are accompanied by persistent thymus. In these it is necessary to irradiate the thymus as well as the thyroid. Care must be taken not to mistake a persistent thymus for a substernal goiter. Here a therapeutic test may make clear the diagnosis, as a thymus always shrinks very quickly after radiation,

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THE PREVENTION OF HYPERPLASIA OF THE THYROID IN THE OPOSSUM BY X-RAYS¹

By O M WALTER, M D, B J ANSON, PH D, and A C IVY, PH D, M D,
From the Departments of Physiology and Anatomy, Northwestern University Medical School,
CHICAGO, ILLINOIS

THE experimental literature, which we reviewed in a previous article (1), shows that *normal* thyroid tissue is resistant to X-rays. The clinical literature reveals practically nothing concerning the effect of X-rays on the hyperplastic gland but does indicate that X-ray treatment benefits, at least temporarily, some 60 per cent of patients afflicted with hyperthyroidism. No observations have been made to ascertain if X-rays may prevent hyperplasia.

Bensley (2) has shown that, if opossums, when confined to cages, are fed a high protein meat diet, the thyroid undergoes marked hyperplasia which is quite evident in two weeks. He could not prevent this hyperplasia with iodine, but it did cause the hyperplastic gland to store colloid. Hence, we had at hand a method for determining if X-rays may prevent hyperplasia of the thyroid.

METHODS

Dosage—The same dosage used in our previous study (1), which was used by B H Orndoff, for the treatment of hyperthyroidism, was employed. For our equipment the factors were as follows: ma, 4, sphere gap, 130, peak, 177, filter, 0.25 mm Cu plus 1 mm Al, portal, 5×8 cm, distance, 50 cm, time, 55 min, yielding 385 r units. One series consisted of one dose given at weekly intervals for four weeks (four doses). A month was allowed to elapse before a second series was given.

Experiments—Sixteen opossums were obtained from Texas. One was killed on the day of arrival and the thyroid which was removed, weighed, and examined his-

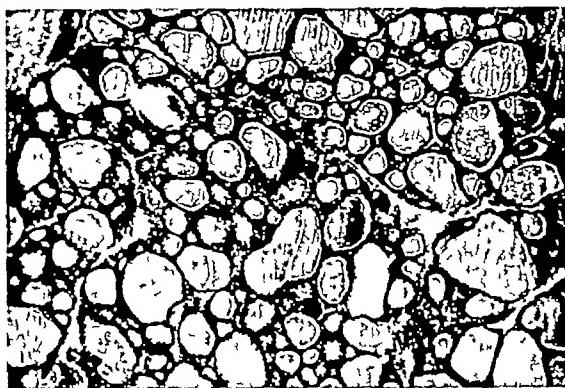


Fig 1 Normal thyroid of opossum on receipt at the laboratory and before meat diet. Magnification 60 times

tologically was found to be normal. Eight were treated with X-ray, seven being used as controls. Three of the eight (Lot 1) treated were started on meat and X-ray treatment at the same time. The other five (Lot 2) were started on meat immediately after the conclusion of the first series.

RESULTS

Since Bensley found that the thyroids were normal on receipt of the opossums and remained so when the animals were kept on a proper diet, we sacrificed only one of our opossums to determine the state of the thyroid on coming into the laboratory. It was found to be normal and a section of it is shown in Figure 1. The average weight of the glands of nine opossums, found by Bensley to be histologically normal, was 157 milligrams.

Lot 1—In this lot, X-ray treatment was started at the same time as the meat diet. A study of Table I shows that the glands of the controls, the animals that received meat but no X-ray treatment, were markedly hyperplastic. Follicles were rare. The measurements show that the glands were

¹Read before the Radiological Society of North America
at the Seventeenth Annual Meeting, at St Louis Nov 30-Dec 4 1931

while the substernal goiter requires operation. Patients with persistent thymus invariably present an unnaturally youthful appearance, seeming to be from 10 to 15 years younger than their real age.

In this series of cases we have included no cancers or other neoplasms of the thyroid—except toxic adenoma—no cysts, anomalies, or any of the various kinds of thyroiditis.

Patients who have made a successful recovery from goiter must be careful that a relapse does not occur no matter what form of treatment may have been used. Not only

must all foci of infection be eliminated, but other hygienic measures must be considered so that the general resistance to infection is kept at the highest possible point. Food must be considered from the standpoint of calcium, iron, iodine, and vitamin content. Starvation for any particular vitamin of the protective group, A, B, and C, is very likely so to reduce the whole infection-fighting mechanism of the body as to render the patient the victim of deficiency diseases which invite infections and may thereby help to reproduce the original thyroid disease.

Fourteen Points Govern Building of Atom Cores—Fourteen points for the government of the atom nucleus have been formulated by Prof W D Harkins, University of Chicago.

Physicists will be aided in their search for the secret of the atom nucleus by these rules. The stability and formation of the ninety-two elements of the chemist's periodic table of atoms are intimately governed by them. They relate particularly to the atomic weight and the atomic number, or order number of the element in the table.

Nature is most often even in making her atom cores, Professor Harkins finds. Nearly all atomic nuclei contain an even number of electrons. The atomic number and the number of protons in the nucleus are generally even, too.

Elements of even atomic number, the newest data indicate, are ten times more abundant on the surface of the earth or on the sun. In meteorites the atom nuclei of elements of even atomic number are fifty times more abundant.

—*Science Service*

TABLE I (LOT 1)

| Serial number | Disposal of animals | Measurement of glands (millimeters) | | | Dosage (series) | Diet-period | Histologic condition | Histologic observations |
|---------------|---------------------|-------------------------------------|---------|-------|-----------------|-------------|------------------------------|---|
| | | Length | Breadth | Depth | | | | |
| Controls | | | | | | | | |
| 1 | Fresh P M | 20 | 4.5 | | | 3/1-7/26 | Fair Epithelial desquamation | Hyperplastic * Follicles rare and small |
| 2 | Killed | 24 | 10 | — | | 3/1-8/4 | Similar to No 1 | Hyperplastic More vascular than No 1 |
| 3 | 2 hrs P M | 18 | 9 | 8 | | 3/1-8/8 | Poor | Hyperplastic Few follicles present Vessels engorged |
| 4 | Killed | 16 | 7 | 8 | | 3/1-10/6 | Good | Markedly hyperplastic Small follicles common (Like No 13, Lot 2) One gland very vascular General picture cord-like masses or small follicles pressed upon by engorged capillaries |
| Treated | | | | | | | | |
| 24 | Killed | 13 | 5 | — | 3 | 5/1-10/6 | Good | Hyperplastic, but small follicles numerous, few large (similar to No 61 of Lot 2) |
| 51 | 12 hrs P M | 7 | 4.5 | — | 1½ | 3/1-6/6 | Poor | Somewhat follicular |
| 55 | Killed | 13 | 7.5 | 4 | 2 | 3/1-7/13 | Good | Hyperplastic, but small follicles fairly numerous (similar to No 24, above, and also to No 61 of Lot 2) |

* The hyperplastic thyroid gland presents in sections a "hugely cellular," as opposed to a "follicular," appearance. The colloid filled follicles of the normal gland tend generally to be replaced by masses of cells which may assume a cord-like arrangement. Such smaller follicles as remain contain little or no colloid and hence reduced lumens bounded by epithelial cells which show a distinct increase in size over that of the cells in an unaltered gland.

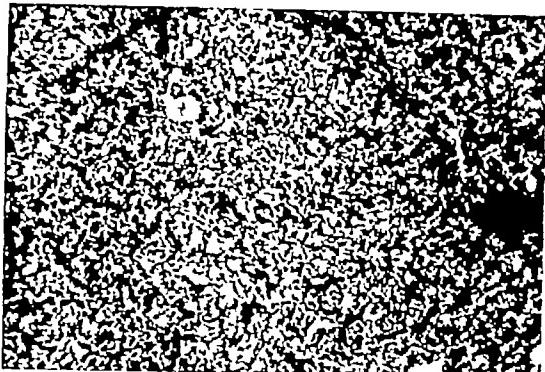


Fig 2 Hyperplasia of thyroid of opossum (13) induced by a meat diet, serving as a control to the X-ray treated thyroid in Figure 3. Magnification 60 times

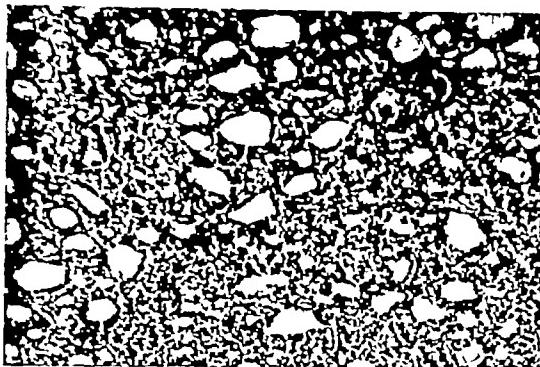


Fig 3 Showing the thyroid of an opossum (65) on meat diet that received two series of X-ray treatments. Hyperplasia has occurred but not to the extent of the controls on meat diet without X-ray. Magnification 60 times

grossly enlarged, while the glands of the animals that received X-ray treatment were hyperplastic, but contained numerous small follicles. The measurements of the glands show that they were smaller than the controls.

Lot 2—In this lot the meat diet was not started until after the first series of X-ray treatments. In general the results are the same as those obtained in Lot 1. The difference in the measurements of the treated and untreated glands corresponds with the weights (Table I). It is to be noted that the average weight of the untreated glands was 404 and of the treated 294 milligrams. Although the treated glands of Opossums 62 and 63 weighed as much as the untreated

the histologic picture was quite different (Figs 1 and 2)

Epilation of the hair of the neck occurred in all opossums which received two or more series

These results show that X-rays in the dosages used prevent, to a considerable extent, the hyperplasia of the thyroid gland of the opossum induced by a diet rich in meat. It is possible that, had we reduced the amount of meat fed and used larger doses of X-rays, the hyperplasia might have been entirely prevented. However, we suspect that, if we had done this, our results would have been more variable and difficult to interpret.

These results support the clinical effectiveness of X-ray treatment of the thyroid gland in some cases of hyperthyroidism and indicate that the reason for failure in others is due to an insufficient amount of X-ray treatment to combat the marked tendency to hyperplasia in these particular cases. Our results suggest the possibility that X-ray treatment may be of benefit in preventing recurrences following subtotal thyroidectomy and that X-ray treatment may be a valuable adjunct to iodine medication in bringing about involution.

This work is now being continued on rabbits in which thyroid hyperplasia can be induced by feeding cabbage (3) and in which metabolic studies can be readily made.

CONCLUSION

The hyperplasia of the thyroid gland that occurs in opossums on a high protein (meat) diet was definitely decreased, but not entirely prevented, by the X-ray dosages employed.

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DISCUSSION

DR. W H OLMSTED (St Louis, Mo) On the one hand, we have the fact that the surgeons have obtained very excellent results from thyroidectomy and, on the other hand, the radiologists have as good results from roentgen therapy. The physician is at a loss to know which of these two therapeutic agents to use in the individual case he may be called upon to treat.

What are the indications for surgery and what are the indications for roentgen treatment? My experience has not been broad, so I cannot present to you hundreds of cases. Three years ago I began to treat a few cases of hyperthyroidism with X-rays, in association with Dr Sherwood Moore, however, I cannot give you Dr Moore's technic.

Some of the facts that our experience has taught us are as follows:

One treatment will reduce, on an average, the basal metabolic rate 10 per cent. It is, therefore, apparent that, with the technic we have been using, the patient with a very high metabolic rate would require six, or more, roentgen treatments. It is our belief that deep therapy should not be given more often than once every six weeks because of the danger of burns. If this be the case, it is apparent that to treat a thyroid patient with a very high rate requires a great deal of time. If he is to have six treatments, it will require 36 weeks to give the treatments. For these reasons we believe that roentgen treatment is adaptable only to those cases which show an increase in their basal rates of not more than 40 per cent. In such patients, one can safely delay treatment. It is also the best therapy in the mild case of hyperthyroidism, because there is less likelihood of a resulting myxedema when one uses the X-rays than when the surgeon is compelled to judge how much thyroid to remove.

A further group in which roentgen treatment of hyperthyroidism has been of particular use is that in which there are complications by other diseases such as diabetes, arteriosclerosis, and heart disease. In this group, we believe that roentgen therapy is of less risk than operation. However I had one case, an old man who had had one stroke of apoplexy,

presenting hyperthyroidism. He was given one roentgen treatment and died during the night following the treatment. I cite this case to show that roentgen treatment is not without some danger.

In conclusion, it seems to me that there is a place for roentgen therapy in the milder types of hyperthyroid cases, especially in those which are complicated by the presence of diabetes, heart disease, or arteriosclerosis. Those cases which are more severe, with high metabolic rates, should have operation. In them, the danger of post-operative myxedema is very slight, whereas, in the milder cases, myxedema is apt to occur. There is a more definite tendency of the return of an elevation of the basal metabolic rate after roentgen therapy than after operation. One cannot emphasize enough the point that Dr Bartlett has brought out the necessity of following cases of hyperthyroidism for months, or years, after the treatment has been begun.

DR O P J FALK (St Louis, Mo) We have heard the radiologist state the mistakes the surgeon probably has made, and we have heard the surgeon state his position. It might not be amiss for us to enumerate a few ways in which we internists make mistakes.

In simple goiters with adenomas, the prolonged use of iodine may precipitate hyperthyroidism. A previously impalpable adenoma may become distinguishable, which, when the symptoms do not subside, often requires surgery. Boothby advises against the use of iodine, except pre-operatively, in all patients over 25 years of age. Morine states that all reactions may be avoided by the use of a maximum of 10 mg daily for not over one month, or not more than 1 mg daily continuously. When we realize that one drop of Lugol's solution contains 8.5 mg of iodine, we readily appreciate how often this limit of safety is exceeded (one minim of syrup ferrans iodide contains 3 mg of iodine).

Another medical error is failure to recognize the syndrome Lahey terms "apathetic type of hyperthyroidism." This comes on in middle or later life, lacks typical clinical signs, and is often characterized only by an unex-

TABLE I (LOT 2)

| Serial number | Disposal of animals | Measurement of glands (millimeters) | | | Weight milligrams | Dosage (series) | Histologic condition | Histologic observations |
|----------------|-----------------------|-------------------------------------|---------|-------|-------------------|-----------------|----------------------|--------------------------------|
| | | Length | Breadth | Depth | | | | |
| Controls 11 | Killed day of arrival | 11 | 4 | | | | | Unaltered follicular structure |
| 10 | Killed | 12.5 | 5 | 3 | 445 | | | |
| 13 | Killed | 15 | 6 | 4 | 380 | | | |
| 14 | Killed | 14 | 7 | 4 | 390 | | | |
| | | 12.5 | 6.5 | - | Av. 404 | | | |
| Treated 61 | Killed | 12 | 7 | 4 | 230 | 2 | 1/7-3/19 | Good |
| 62 | Fresh P M | 15 | 5 | 2.5 | 390 | 2 | 1/7-3/12 | Moderately follicular |
| 63 | 2 hrs P M | 12 | 7.5 | 3 | 390 | | | |
| 64 | 6 hrs P M | 18 | 5 | 3 | 500 | 1 | 1/7-1/17 | Poor |
| 65 | Killed | 10 | 5 | 3.5 | 180 | 1½ | 1/17-3/18 | Poor |
| | | 14 | 5 | 3.5 | 170 | 2 | 1/17-5/2 | Good (Fig 3) |
| | | | | | Av. 294 | | | |
| | | | | | | | | Follicular, more so than No 61 |

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|----------------|-----------------------|-------------------------------------|---------|-------|-------------------|-----------------|--------------|----------------------|---|
| | | Length | Breadth | Depth | | | | | |
| Controls 11 | Killed day of arrival | 11 | 4 | — | | | Not dictated | Good (Fig 1) | Unaltered follicular structure |
| 10 | Killed | 12.5 | 5 | 3 | 445 | | 1/7-3/12 | Good | Reduced number of follicles, hyperplastic |
| 13 | Killed | 15 | 6 | 4 | 380 | | 1/7-3/19 | Good (Fig 2) | Further reduction in number of follicles, hyperplasia more marked than in No 10 |
| 14 | Killed | 13 | 7 | 4 | | | | | No 10 and No 13 |
| | | 14 | 6 | 4 | 390 | | 1/7-3/19 | Good | Change intermediate between that of No 10 and No 13 |
| | | 12.5 | 6.5 | — | Av 404 | | | | |
| Treated 61 | Killed | 12 | 7 | 4 | 230 | 2 | 1/7-3/19 | Good | Moderately follicular |
| 62 | Fresh P M | 15 | 5 | 2.5 | | | | | |
| 63 | 12 | 7 | 3.5 | 3 | 390 | 2 | 1/7-3/12 | Fair | Similar to No 61 above |
| 64 | 2 hrs P M | 18 | 5 | 3 | | | | | |
| 65 | 15 | 5 | 3 | 3 | 500 | 1 | 1/7-1/17 | Poor | Follicular—more so than other treated specimens |
| | 6 hrs P M | 13.5 | 4 | 3 | | | | | |
| | 12 | 5 | 3.5 | 3 | 180 | 1½ | 1/7-3/18 | Poor | Follicular—more so than other treated specimens |
| | Killed | 10 | 5 | 2 | 170 | 2 | 1/7-5/2 | Good (Fig 3) | Follicular, more so than No 61 |
| | 14 | 5 | 3.5 | 3 | Av 294 | | | | |

cide that it is useful as a palliative, as a means which will produce results lasting much longer than three months and possibly over a period of several years, amounting to a cure in a considerable percentage of cases

I have had no experience with injections nor have I been associated with clinics in which injection methods have been employed. I had an experience with one case in which hot water injection had been used, but finally radiation was employed, apparently with good results, lasting something over three years. I do not know whether it was the hot water injection or the roentgen treatment that did the work.

I have never seen a myxedema resulting from irradiation. I had one patient with carcinoma of the thyroid who was referred for roentgen therapy before the wound was healed. A portion of the middle lobe had been removed to take the pressure off the trachea, so that the patient could breathe. She was then referred for roentgen treatment in the hope of accomplishing something. I gave her persistent treatments over 14 months, treating her with a series every three weeks. After this period the patient was apparently cured and I let her go. Now, 16 years have gone by and she is still alive and well. Ever since the basal metabolic method has been introduced I have had her metabolism estimated every year or two. It is approximately normal and has been so ever since we began the estimations. If I ever had a case that ought to have exhibited myxedema, that is the case. I also have a very strong impression, based on experimental work, that we cannot damage a normal thyroid very much by roentgen therapy.

I have had experience with six malignancies of the thyroid, as I remember *et tempore*. Three of these patients are alive.

I think there are certain definite contraindications to radiotherapy. We have mentioned the economic reasons, with which we will all agree, for it is sometimes cheaper to do the operation and get the patient back to earning his livelihood. Second, impending heart damage may indicate immediate surgery. I do not think we are justified in waiting for a temporizing method to stop the damage that

is going on when a surgical operation will stop it very shortly. I do not believe roentgen therapy is indicated when we are dealing with a large toxic thyroid. It is damaging both by size and by toxicity and should be relieved by surgery. I have not had any success in the roentgen treatment of substernal thyroids. Patients with small toxic goiters, not exhibiting serious heart damage, and whose economic situation permits it, are ideal subjects for roentgen therapy.

DR E L JENKINSON (Chicago). Regarding what Dr Richter said about "cure," I have tried to guard against using the word "cure." In most of the papers I have written on the roentgen treatment of thyroid disease I have tried to use "symptom-free," rather than "cure." I think as he does—patients may have the disease though they live fifty years.

I think I would prefer to treat a patient with a high metabolic rate rather than one with a rate of approximately 20. It has been our experience that patients with high metabolic rates have responded better than those with low rates. In older patients our results have not been good, in fact, I had rather not treat them.

Regarding mortality. Eight years ago we reported two deaths. There is no secret about it—these two patients died. They have been reported. To what death was due, I do not know. Following the second series, one patient became bronzed and died.

We have treated over 1,000 patients. Those patients did not come to me directly, but were referred by very competent internists on our staff. If the method had absolutely no virtue, no curative power, I do not think those men would have sent the patients for therapy.

DR WILLARD BARTLETT (closing). I have nothing to add, except that this has been a wonderfully helpful and illuminating session. I value particularly the remarks of Dr Case, because he has been both a radiologist and a surgeon.

DR H M RICHTER (closing). I am afraid that oftentimes men fail to get together in dis-

plained weight loss, tachycardia, and myasthenia

Another mistake is lack of realization of the potential menace, after the fortieth year, of an adenomatous goiter without hyperthyroidism. In these cases, hyperthyroidism frequently develops so insidiously that it may exist for a long time before the patient is aware of any symptoms.

Plummer has recently called attention to the frequency of this fact, as well as to the surprising frequency of malignancy of this gland, the ratio being 27 per cent of all the thyroids removed at the Mayo Clinic. However, we must remember that this proportion exists for the truly pathologic glands actually removed, and not for cases of thyroid adenomas which are asymptomatic, hence untreated.

As to the choice between surgery and the roentgen ray, in the uncomplicated case, the consensus of opinion unquestionably seems to favor removal. Yet we feel that roentgenotherapy has a very definite place in the treatment of cases when surgery is inadvisable or refused.

The treatment of thyrotoxicosis is a problem in which, in any individual case, adherence to fairly well established precedents must be tempered with sound judgment in the choice of procedure. Here again, the patient must be treated, and not the disease alone, for, in hyperthyroidism, the man the disease has is of equal importance with the disease the man has.

Inasmuch as our choice of procedure is necessarily bound to be influenced, to some extent, by our particular field of endeavor, our contacts, and experience, we must constantly keep in mind the limitations, as well as the potentialities, of any particular form of treatment.

The management of every thyrotoxic case is essentially a medical problem, because of the fundamental metabolic upheaval, the cardiovascular involvement, the neuropsychic upset, and the autonomic nervous system imbalance. Nevertheless we must realize, in the majority of severe cases, particularly of the toxic adenomatous type, the inadequacy of

complete ultimate medical control of the situation.

The fundamental principles of medical treatment are recognized to be:

- 1 Bed rest and mental quietude
- 2 High carbohydrate diet, with limitation of protein, and the elimination of caffeine

- 3 Use of sedatives and judicious iodine therapy

Among the more common medical errors in the management of thyrotoxicosis seems to be the indiscriminate use of iodine for unduly protracted periods and in unwarranted amounts. In thyroid disease, there are many untoward effects of iodine that are serious. The routine established in hyperthyroidism by Plummer and Boothby—from 30 to 40 drops of Lugol's solution daily as a purely pre-operative measure—has apparently resulted in the widespread habit of giving large doses over long periods of time, as a medical treatment in all types of goiter. Many of the very cases ultimately most harmed improve so markedly the first two weeks that the treatment is often carried on to the stage of actual damage.

DR JAMES T CASE (Chicago) I have no definite convictions about the relative value of radiation and surgery. I have seen both methods used and noted failures in both.

I would like to make some remarks in relation to the palliatives which may be employed in tiding a thyroid patient over an emergency until such time as surgery may be employed. Dr Bartlett mentioned these. I would like to recall what he said and thank him for the courtesy in underscoring radiation.

First I would name iodine medication, but not for long periods. I do not think there is any palliative that can be continued over a great period of time without danger to the patient.

I would put ligation next because, after ligation of the thyroid vessels, usually the superior, if surgery is contemplated it must be done within two or three months at the latest or else the good done by the ligation will have passed.

I then put radiation. We will have to con-

cited—that patient is not well when we get through but he has thyrotoxicosis—sometimes tetany, sometimes hyperthyroidism

Myxedema is a different condition I aim to secure a temporary hypothyroid state in patients who were thyrotoxic Thyrotoxicosis is incompatible with the absence of sufficient thyroid to produce it

DR BARTLETT Dr Williams, I am sorry that I made an erroneous statement about thyroidism

The patient who has done the best in the experience of our clinic is the one who ends up with a basal rate of perhaps from —5 to 0 Now there is no mistake in that statement

The other class of patients to which I referred numbers those who have succeeded in living through a number of these crises of which Dr Plummer has spoken, who have not died on the way and have finally, as Dr Carter said, burned out—the heart has been so terribly impaired that the individual cannot get around, the liver, kidneys, and other organs have been so impaired that they do not function properly

DR WILLIAMS Dr Bartlett drew a different picture of his material from the rest of us and shows perhaps why we cannot get together, why our groups are different I know that the material mentioned by the medical side did not seem to have the picture of such seriousness and there were no deaths or emphasis on severity in the radiologic group That probably is the reason why it is hard for us to come to the same conclusion

I think we can draw this conclusion as Dr Jenkinson says, the medical men who keep on sending thyroid patients to the radiologists must be satisfied with the improvement under roentgen treatment The surgical men who keep getting cases from the medical men also must feel very contented with the work that they are doing

I have noticed some of these very earnest surgical converts among my medical friends who never send me a case for radiologic treatment They say, "Why, Doctor, I get results by referring my cases to surgery and why shouldn't I keep on?" And I would say that they should So we are all trying to understand a very difficult problem

cussions because they use different languages and they do not understand one another

In my work, every patient who fails to get complete relief from thyrotoxicosis, whose metabolic rate fails to drop to, or below, normal, is passed as a failure No case is passed as improved

The basis for that attitude is the idea that the patient who is merely improved is still toxic, though less toxic than previously He, therefore, is in the same need for proper medical or surgical care that he was when he came under treatment in the first place The patient whose basal metabolic rate has dropped from +60 to +40 under treatment is still just as much in need of treatment as if it has risen from +20 to +40 without treatment A rate of +40 in itself is indicative of the need for further treatment The patient, therefore, must be regarded as toxic and his previous treatment a failure I believe that patients treated by radiotherapy should be classified in the same way, and the group of so-called improved cases entirely eliminated, or, rather, transferred to the group of failures

This is illustrated by the paper of one of the speakers who had treated some thousand cases by radiotherapy, with approximately 70 per cent cures and 7 per cent failures There is a deficit of 23 per cent somewhere It seems to me that that 23 per cent should be added to the 7 per cent, making a total of failures of 30 per cent That is a crushing number of failures

Dr Plummer may be interested in the case reported by Dr Phemister of a patient who had a high-grade thyrotoxicosis He was operated upon two, or possibly three, times, the final operation disclosing only two tiny fragments of thyroid tissue The patient finally died of thyrotoxicosis At autopsy, no further thyroid tissue was found, though the autopsy had to be somewhat limited In the present state of our knowledge it is simply impossible to explain such a finding

DR ALDEN WILLIAMS (closing) I do not think we need be surprised that the radiologist feels in a haze and scarcely knows how to evaluate his own statistics He has only the one-sided view Dr Case, who is

both surgeon and radiologist, has a two-sided view and he admits that he is not certain which is the better method of treatment for this condition

I like very much Dr Bartlett's choice of words and his attitude of friendly fairness He did seem to make one little inconsistent remark, that the subthyroid patient was worth nothing to himself or to anyone else, also saying a little later that the milder subthyroids are the ones that stay well There must be real subthyroids and mild subthyroids

I perhaps did not hear distinctly when Dr Richter quoted his statistics I may be wrong—that he had just the two groups the cases which were considered rehabilitated and the cases considered failures

DR RICHTER All were failures that were not cures in Dr Bartlett's definition Every improved case was a failure

DR WILLIAMS I noticed that you were looking at our improved cases and placed them in the failures, and you did the same with your own In your failures, did you decide that from the elevated basal rate?

DR RICHTER Every patient was regarded as a failure whose metabolic rate was above +15, quite irrespective of other things at the time of the final report

With that there was the clinical study of the patient In these 18 cases, as I said before, if we did not absolutely include every case that showed this raised metabolism, we would exclude certain cases on account of the physical condition of the patient Every such patient was a failure

DR WILLIAMS Then I had in mind the subthyroid that follows the surgical work Were any of those considered failures?

DR RICHTER At the start, I said I would confine my paper to thyrotoxicosis If you amputate a leg for a carcinoma, though the patient would be a leg minus, he would be regarded as a cure The patient who has, for instance, a residual pathologic condition—damaged heart—a damaged leg in the example

ficiencies in certain of the long bones Professor Oluf Thomsen, Copenhagen, considers syndactylism unassociated with polydactylism as evidence of "less radical disturbance of the normal development." This last statement may seem unrelated to some of the foregoing, and yet study of the individual cases will prove the necessity for considering the importance of Professor Thomsen's statement in the light of biologic experimental data.

In 1898, Cotton and Chute (11), reported three cases of congenital defects of the fibula, and they stated

The amniotic theory seems to explain all lesions pretty clearly. We cannot but accept it as at least the most plausible theory yet advanced. The origin of the typical deformity would be, then, as follows: between the fifth and the eighth week, pressure of a too tightly fitting amnion interferes with the development of the exposed fibula and the outer toe or toes of the exposed foot. Lack of space determines the bend of the growing tibia, the adhesion which produces the so-called scar is a result of contact of the most salient point of the tibia with the enveloping wall. The persistent lack of growth of the whole limb is probably a result of deficient vessels and nerves due to the early pressure, as well as of the disease.

Tubby (40) states that "absence of the radius or fibula, though rare, is more common than absence of the ulna or tibia." In discussing theories relative to congenital defects in long bones, Tubby cites Henry Ling Taylor.

Taylor sums up two of the theories generally advocated (1) the primitive fin theory of Gegenbauer, and (2) the amniotic theory.

The second theory ascribes the anomalies to a mechanical cause, namely, the pressure of the amnion and deficiency of fluid at the time of development of the arms, namely, about the fifth week.

He, too, considers the amniotic theory the most plausible.

Whitman (45) states that congenital absence of the fibula is rare and gives a number of theories of origin. According to him

The cause of deformity, associated with absence of bone, may be either an original defect in the germ or it may be due to interference with its development. In some instances amniotic adhesions may be one of the predisposing causes.

In 1914, G. Potel (34) in a series of remarkable papers on congenital malformations of the limbs points out

All genuine malformations are of embryonic origin, namely, due to an original germinal error. The amnion may determine easily recognizable traumatic lesions, but has nothing to do with the pathogenesis of true malformations. The modifications of the initial embryonic type, known as malformations, are produced—no matter to what species the embryo belongs—according to two mechanisms histogenic variation and disease.

The primitive or plastic embryonic cells are endowed not only with an almost indefinite power of proliferation, but, moreover, they enclose the material for several differentiations, actually, at the onset, the material for all differentiations. When a modification of the medium or environment supervenes, the plastic cellular substance endeavors to adapt itself to the new vital conditions offered to it. It develops in an atypical manner, but what very distinctly characterizes this atypical evolution—is the mutation of the primitive type—is the correlated initial adaptation of all the elements which enter into the constitution of the modified organ. In the case of disease of the plastic cellular material, the protoplasm undergoes a more or less complete disintegration. The cell may die or it may suffer, in the latter case, the disease lasts a certain time the differentiations are diminished, modified, or even arrested. Gradually, recovery ensues and the phenomena of differentiation and proliferation

SKELETAL DISTURBANCES AND ANOMALIES¹

A CLINICAL REPORT AND A REVIEW OF THE LITERATURE

By ISIDORE COHN, M.D., F.A.C.S., Professor of Clinical Surgery, Tulane University,
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THIS report is based on a series of personally observed cases of skeletal disturbances and anomalies. It includes cases of syndactylyism, hypodactylyism, polydactylyism, one case in which the thumb had three phalanges, ectromelia, deficiencies of the fibula, absence of carpal bones, and fusion of carpal bones. I am including also cases of dyschondroplasia for reasons which will be developed in the body of the paper.

The literature, both American and foreign, abounds in clinical reports of similar cases, but there is so much confusion with reference to etiologic factors and so little attention paid by clinicians in their reports to the remarkable experimental and biologic studies of Dareste, Stockard, Bagg, and others that I am prompted to collate some of the literature.

The fantastic theories which have been offered, based purely on imaginative, non-existent factors, should be discarded in favor of experimentally proved evidence such as that advanced by Stockard and Bagg.

Popular tradition holds to the theory of primogeniture. Macklin (29) presented conclusive evidence that the first-born is not more liable to show hereditary defects than are the other children. After a study of 1,050 cases of defective children, she found that of these only 295, or 28 per cent, were first-born.

It is true, I believe, that all defects and deformities can be shown to be hereditary if we accept biologic experiments as sufficient proof. The absence of such proof in a particular patient is probably due to our in-

ability to obtain accurate information relative to his ancestry.

There are many theoretic explanations of the etiology of defects and deformities.

David Perkoff (33) mentions the following which have been advanced with reference to syndactylyism:

- 1 Lesions of the fetal nervous system (Guerin)
- 2 External pressure and traumatism during pregnancy (Cruveilhier)
- 3 Embryonic amniotic adhesion (Lannelongue)
- 4 Amniotic loops or bridles (Dareste)
- 5 Reversion to early conditions (Darwin)
- 6 Osler thinks it occurs more frequently in children of syphilitic appearance
- 7 Edwards states that it is a stigma of degeneration, occurring in persons of weakened intellect
- 8 Goldman asserts that syndactylyism may be regarded as an arrest of development since during fetal life the fingers are bound together for a time by webs of varying extent, the thumb almost always remains free, and in most instances two fingers only, usually the third and fourth, are bound together.

This is typical of the clinical papers. Many theories are presented, but no definite conclusions are drawn.

In order to correlate syndactylyism and other defects or skeletal disturbances, it must be remembered that in the literature the same theories of origin have been advanced for each.

Many defects and deformities may be found in the same individual, for instance, syndactylyism is frequently associated with polydactylyism, hypodactylyism, and de-

¹Presented before the Southern Surgical Association
White Sulphur Springs, Virginia Dec. 8 1931

pal bone, a supernumerary digit provided with a well formed nail. This digit had two phalanges, one of which articulated with the metacarpal bone. The thumb itself was nearly as long as the index finger, the appearance of which it simulated, and was provided with a metacarpal bone and with three phalanges, movable articulations existing between each of the members. The digit in question, though simulating the appearance of the other members of the series, was yet functionally a thumb.

Windle was able to find twelve such cases in the literature reported by Struthers, Runderger, Otto, Gegenbauer, Wenzel, Gruber, and Annandale. These cases are abstracted by Windle and anyone interested in the subject may well review the original articles.

In his discussion of the nature of the three-phalanged pollex, he says:

It will be observed that the three-phalanged pollex may exist (1) alone, representing the normal pollex, or (2), with a supernumerary pollex. In the latter case both pollex and supernumerary, or prepollex, may possess three phalanges. It will also be noted that, as in polydactylism, the influence of heredity is met with in several of the cases.

At the outset, we are met with the question as to whether these three-phalanged digits should be considered as of the nature of thumbs or not.

It will be noticed that in twelve cases the three-phalanged digit replaced the normal pollex and functioned as a thumb, being, in the instances in which any note is made of the fact, opposable to the other digit. To call such a digit an instance of a double index with (presumably) absent pollex, is, to my mind, a misuse of terms, unless, indeed, we are to confine the term 'pollex' to a two-phalanged digit, a limitation for which I can see no justification. A consideration of the musculature in cases of double pollex will, I think, establish the fact that these digits are much more of the nature of pollices than of that of the other digits.

His conclusions are:

1 That the three-phalanged pollex, when existing in a pendactylous manus, is not an example of duplication of an ordinary digit, but is a true thumb.

2 That the musculature shows that, in cases in which there is an additional digit on the radial side, it and the digit next to the index both partake of the nature of thumbs, and may be looked upon as the first and second digits of a heptadactylous manus.

We note also from Windle's work that he quotes Struthers, who believes that the metacarpal or metatarsal, respectively, has disappeared and that the normal condition is that the thumb has three phalanges. Struthers says:

The facts in comparative osteogeny show that the position of the epiphysis is decisive in establishing the view that the bone which is wanting in the human thumb and great toe, and in the internal digit of other five-toed mammals, is the metacarpal and metatarsal, although custom and convention lead us to apply these terms to the bone which, homologically, is the proximal phalanx.

Continuing with our study of cases representing skeletal disturbances and anomalies, we note that the hereditary character of congenital disturbances such as syndactylism, polydactylism, and deficiencies of particular bones is evident from the literature. The question of whether it represents a dominant or recessive character has been investigated clinically by Snyder (35). His evidence points to a definite recessive factor for polydactylism.

He says:

During the Summer of 1928, in connection with an intensive study of human blood groups, a large number of negroes in Pamlico County, North Carolina, were found, who showed an extra fifth finger on each hand.

are restored. But the momentary arrest has resulted in a loss of equilibrium, a local modification, which will manifest itself at birth under the aspect of a malformation. A classification of the congenital deformities is difficult.

All the varieties of localized osseous dystrophies, in spite of their apparent complexity, may be grouped under three principal headings:

- A* Developmental disturbances of the skeletal rudiments
 - 1 Ectromelias
 - 2 Hypertrophies
- B* Disturbances of segmentation
 - 1 Abnormal fusions of the segments
 - 2 Exaggerated segmentations

Exaggerated segmentation, resulting in polydactylysm, is a relatively frequent malformation. It may be said to be the prototype of the hereditary skeletal modifications. In certain observations, a thumb with three phalanges existed at the same time as polydactylysm.

- C* Axial deviation
- D* Superadded aberrant heteroplastic nuclei (osteogenic exostoses)

The various processes do not exclude each other and are even very often found associated in the same individual.

Bagg (2), discussing polydactylysm, states:

Stockard and others have shown that a reduplication of embryonic parts may be brought about experimentally by a temporary arrest of embryonic development at a critical growth period.

When the growing apical bud of a twig is arrested in development by pinching or other methods, dichotomous growth occurs, and as a result the two adjacent axillary buds, quiescent during the supremacy of the apical bud, begin to develop 'twin' branches. Similarly, Stockard has produced a reduplication of parts and marked degrees of twinning in trout embryos by arresting the development at a critical growth period.

Tubby (40), discussing polydactylysm, states:

The condition is often hereditary and may be traced through several generations, and frequently exists both in the toes and in the fingers.

It is difficult to speak of types, as the individual cases vary so much, but the most frequent form is a supernumerary little finger. Next to that is a double thumb, or pollex duplex. Sometimes the additional thumb possesses three phalanges.

The last statement is of particular significance because anyone who has studied the human hand and foot has noted that the metacarpals and metatarsals of the first digit, or thumb and great toe, have their epiphyses at the proximal end, while the epiphyses of the other metacarpals and metatarsals are found at the distal extremity.

One of the cases in this group presented a first digit with three phalanges, thus I originally considered an accessory index finger. The patient had a definite syndactyl condition of the first and second digits, and for this reason I do not know whether the musculature is that of the thumb or an index finger. Details of the case are included in the clinical section of the paper.

Observations similar to this have been made by Potel, Tubby, Windle, Struthers, and others. The most extensive study of this "anomaly" was made by Windle as long ago as 1892. He collected in all twelve cases, including his own. Because of the importance of the unsettled question of whether or not the thumb has, like other digits, three phalanges, the metacarpal disappearing in development, I am going to quote extensively from Windle's original paper.

Windle's patient had "five fingers and a thumb on one hand, and five fingers and no thumb on the other" (47). He found the following condition. The thumb on the left hand bore, on the radial side of its metacar-

the fetus at birth as a result of muscular contraction in parts which are retained in approximation during uterine life

Paralysis, due to a disease of the spinal cord, is a factor in the production of non-congenital club-foot in man, but such a cause can hardly be operative in congenital cases, because the leg in congenital talipes does not at all resemble the leg in infantile paralysis, and, if the deformity were due to a lesion in the central nervous system and paralysis resulting therefrom, not a single group of muscles, but a whole side of the body would be paralyzed, which is not the case in children with congenital club-feet.

The review given above leaves the question of the etiology of congenital club-feet and other congenital defects of the limbs entirely unsettled, and nowhere do I note reference to arrested embryonic development associated with a specific localized lesion in the clinical data upon which to base a tenable theory.

I shall briefly summarize the experimental results of the present communication before giving an explanation for the causation of foot defects as seen in my animals.

Over 5,200 individuals have been examined from my strain of inbred animals. They are descendants of the nineteenth generation of certain X-radiated mice. In this group, there has appeared a marked tendency to abnormal development. This tendency is inherited in approximately a mendelian fashion and is definitely recessive to the normal.

These observations indicate that clubbing and other defects of the limbs usually occur early in embryonic development and are first associated with localized arrests in development.

The results show still further that there is apparently an association between the degrees of severity of the pathological embryonic disturbance and, subsequently, the resultant type of foot abnormality. Congenital amputation in man has been ascribed to constriction of a fetal limb by either the umbilical cord or amniotic bands, but such an explanation does not fit the observed facts in my strain of animals.

Turning from Bagg to Stockard (36), we find that as early as 1920 he arrived at the following conclusions:

The ordinary progress of embryonic development gives rise to individuals of rather uniform structure, yet there may be numerous slight variations and defects in the structural composition of various organs and parts. When the same deviations become exaggerated they may be ranked as serious deformities or anomalies. This fact renders the analysis of normal developmental processes and the experimental study of monstrous development one and the same problem.

For the past two years I have claimed that all types of monsters not of hereditary origin are to be interpreted simply as developmental arrests. Such a position has been taken by others (Dareste, 1891). However, I propose, at this time, to present evidence which clearly demonstrates the truth of the claim.

First, all types of monster, double as well as single, may be caused by one and the same experimental treatment; second, any one type of monster, such as cyclopia, may be produced by a great number of different experimental treatments; third, all effective treatments tend, primarily, to lower the rate of development; and fourth, the type of monster induced depends upon the particular developmental moment during which the developmental rate was reduced. Slowing the rate at one moment will produce a double monster or identical twins and at another moment, by the same method, will give rise to the cyclopean defect. In fact, the same thing which causes the double monster may later in development induce one of its heads to be cyclopean.

Thus, there is no longer any ground for considering certain defects as specific responses to particular treatments. And there is as little reason for further description of individual monsters, since all belong to the same class and the individual differences simply result from the different moments during which the developmental interruptions have acted.

In view of experimental results, it becomes

Careful family histories were gathered, and the results are presented herewith

If one parent is polydactylous and the other normal, polydactylous children should make up at least half, and probably more, on the average, of the offspring, if the character is dominant. From 16 such matings, 24 polydactylous and 26 normal children are recorded. This is a slight bit of evidence for recessiveness. Two families are recorded in which, although one parent was polydactylous, all of the children were normal (in one case four, and in the other six), these are further indications of recessivity.

Summing up the evidence for recessiveness, the character does not fulfill the requirements for dominance (must occur in every generation, must show up on the average in half or more of the offspring), while it does meet the criteria for recessiveness (must be homozygous when it appears, as evidenced by the result of mating two individuals showing the character, may skip one or more generations and appear when neither parent shows the character).

He quotes other workers whose conclusions are not in agreement with his own.

Many cases of polydactylism are on record. The character appears to be regularly dominant, although in some instances it is imperfectly so. Thus, Lucas gives a family history in four generations in which there was one case of failure to dominate. Bellowitz gives several family histories in which polydactylism appears to be dominant. Miles considers the character as dominant. In poultry, polydactyly appears to be dominant.

In order to obtain first-hand information with reference to skeletal disturbances, we must turn to the writings of embryologists. Bagg and Stockard have done experimental work which may well be accepted as conclusive.

Bagg (2) states:

The origin of congenital defects of the limbs is a much confused subject. An inherited ten-

dency to limb abnormalities has been noted in certain families, but no satisfactory explanation for their origin has been offered.

Abnormalities of the limbs are definitely inherited. They are recessive to the normal inheritance. When considered as one of the manifestations of a general tendency to abnormal structure, they approach the mendelian expectation in behavior.

The occurrence of congenital amputation or the entire loss of the distal portion of a limb at birth is, in the mind of the writer, but an exaggerated or more severe form of the same arrested embryonic development that produced clubbing, syndactyly, and hypodactyly in these animals.

Discussing the theories which have been advanced by clinicians, Bagg says:

Congenital clubbing of the limbs in man has been attributed to accidental mechanical disturbances that produce unusual and prolonged pressure upon the fetus while developing in the uterus, to the absence of amniotic fluid, in consequence of which the uterus was thought to press directly upon the feet of the fetus and become an efficient cause for their turning, to an arrest in the rotation of the limbs before birth, in which case the feet retain their fetal position with the little toes facing one another, and, finally, clubbing of the limbs was thought to result mainly from disturbance in the central nervous system of the developing embryo.

The writer believes that pressure upon the fetus *in utero* is unlikely to produce clubbing of the limbs, especially as the defect has been noted in uterine life as early as the third month of gestation and is frequently met with in fetuses between the fourth and fifth months. Deficient amniotic fluid can hardly be a potent factor in the production of clubbing, as in many well observed cases of this kind, perfectly formed infants have been born, and *vice versa*. If the theory of retarded rotation of the limbs before birth in relation to the production of club-feet was at all tenable, then we would have to account for the absence of bent knee, bent thigh, bent arms, etc., in



Figs 1 and 2 Case 1 Complete syndactyly of the right hand

not bear out this, at operation we did find an additional terminal phalanx

The surgical problem involved in this case naturally consisted in trying to separate all of the fingers and to obtain a useful hand. On account of the age of the baby, it was decided to do several operations rather than one long operation. The end-result justified the means. The operative procedure followed was the Agnew operation, which I prefer because it provides for the formation of a web between each of the fingers.

Case 2 C S., aged 4 years. The diagnosis was syndactyly, the thumb presenting three phalanges (Figs 4, 5)

Physical Examination—Examination on June 4, 1930, showed that separation of the "webbing" had been attempted in a previous operation, but the fingers had grown back together again. The Diddo type of operation seemed to have been adopted.

On the left hand there were four fingers and a digit, which was shorter than the index finger and was webbed with the index finger at the junction of the middle and terminal phalanges. There was complete webbing of the digits which corresponded to the thumb and index finger. A scar of a previous operation, probably of the Diddo type, was present. There was slight flexion of the first digit.

Palpation of what I took to be the first metacarpal revealed a long, thin bone much smaller than the other metacarpals. There were three phalanges.

On the radial side of the index finger of the right hand there was a small nail and what probably was an accessory digit on the radial side of the index finger, giving the index finger a broad, but step-like, appearance. The terminal phalanx with the nail was slightly flexed.

Palpation just below the styloid of the radius revealed a small, apparently rudimentary, first metacarpal which had a sharp point, very much like a cypress knee. Below that I felt a metacarpal which was continuous with the index finger. On the outer side of the first phalanx of the index finger, there was a small, apparently rudimentary, first phalanx which was movable and seemed to have no fixed point above. I could make out two phalanges, definitely.

My impression was that we had an accessory index finger on the left hand, and an absence of a thumb, the reason I believed this was because there were three phalanges.

It will be seen that my first impression of this case was that the first digit was an extra index finger and not a thumb.

It has been shown, in the section of the paper in which the literature is reviewed,

evident that normal development of the vertebrate embryo depends acutely upon the stability of certain factors in the environment. Changes in the condition of moisture, temperature, and oxygen supply are the most frequent causes of embryonic death as well as monstrous development. The highly complex forms, such as birds and mammals, with a long embryonic period, have partially succeeded in controlling their developmental environment. But in no case is the regulation constantly perfect and this fact is the underlying cause of frequent malformations and monstrous productions.

Comparison of the above statements with the work of Struthers shows that these embryologists are in agreement.

In view of the biologic data which I have quoted, I feel that we should accept the evidence and discard the fanciful theories. Bagg has shown, definitely, that the amniotic adhesion theory of origin is not tenable. I mention this theory in particular because it seems to have arrested the attention of, and has been accepted by, Cotton and Chute, Tubby, Taylor, Windle, and other clinicians.

Summarizing the evidence, I think that we are justified in concluding:

- 1 Deformities and defects are hereditary.
- 2 They are due to arrests of development at a particular moment.
- 3 There is no good reason to attempt to classify hereditary defects, as they can be legion.
- 4 Considering the classic work of Potel, Bagg, Stockard, and Jansen, there is reason to consider that exostoses and other dissociation phenomena which appear after birth are the result of biologic arrests. This will be discussed more fully later.

CLINICAL REPORT

In this series there are three syndactyl cases, all of which are associated with additional evidence of disturbance of develop-

ment, thus bearing out the statement of Professor Thomsen, "Syndactylism unassociated with polydactyly is evidence of less radical disturbance of normal development."

Case 1 Baby G D, aged 8 months. There is no familial history of congenital malformations.

The patient was referred by Maud Loeber, M.D., with a diagnosis of syndactylism of the right hand (Figs. 1, 2, 3).

Physical Examination—The right hand showed five well developed fingers and thumb. There was a definite web which united all of the fingers and the thumb. All of the fingers, except the index finger, were well developed and their outlines were definitely made out. The index finger was broader than the thumb and the nail of the index finger showed a definite bifurcation. The breadth of the nail was 1.5 cm., the nails of the middle and ring fingers were a little over 0.75 centimeter. All fingers were flexed. The web between the thumb and index finger was very narrow. I could make out five first phalanges, but it seemed that the index finger had accessory second and third phalanges.

The X-ray films did not reveal any evidence of extra digits or an accessory phalanx as was indicated by clinical examination.

Three operations were deliberately planned and done before all of the fingers had been separated.

Comments—There was no history that the defect was a familial characteristic. There was one perfectly normal child in the family, born prior to this deformed child. The only defect which the patient exhibited was complete syndactylism of the right hand. The terminal phalanx of the index finger was twice as broad as its fellow on the opposite hand. The nail looked like a double nail, suggesting that there were accessory second and third phalanges on the index finger. Although the X-ray films did



Figs 1 and 2 Case 1 Complete syndactyly of the right hand

not bear out this, at operation we did find an additional terminal phalanx

The surgical problem involved in this case naturally consisted in trying to separate all of the fingers and to obtain a useful hand. On account of the age of the baby, it was decided to do several operations rather than one long operation. The end-result justified the means. The operative procedure followed was the Agnew operation, which I prefer because it provides for the formation of a web between each of the fingers.

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Physical Examination—Examination on June 4, 1930, showed that separation of the "webbing" had been attempted in a previous operation, but the fingers had grown back together again. The Diddo type of operation seemed to have been adopted.

On the left hand there were four fingers and a digit, which was shorter than the index finger and was webbed with the index finger at the junction of the middle and terminal phalanges. There was complete webbing of the digits which corresponded to the thumb and index finger. A scar of a previous operation probably of the Diddo type, was present. There was slight flexion of the first digit.

Palpation of what I took to be the first metacarpal revealed a long, thin bone much smaller than the other metacarpals. There were three phalanges.

On the radial side of the index finger of the right hand there was a small nail and what probably was an accessory digit on the radial side of the index finger, giving the index finger a broad, but step-like, appearance. The terminal phalanx with the nail was slightly flexed.

Palpation just below the styloid of the radius revealed a small, apparently rudimentary, first metacarpal which had a sharp point, very much like a cypress knee. Below that I felt a metacarpal which was continuous with the index finger. On the outer side of the first phalanx of the index finger, there was a small, apparently rudimentary, first phalanx which was movable and seemed to have no fixed point above. I could make out two phalanges, definitely.

My impression was that we had an accessory index finger on the left hand, and an absence of a thumb, the reason I believed this was because there were three phalanges.

It will be seen that my first impression of this case was that the first digit was an extra index finger and not a thumb.

It has been shown, in the section of the paper in which the literature is reviewed,

and also from the review of my own observations on normal bones and joints, that the position of the epiphysis of the first metacarpal corresponds with the epiphysis of the first phalanx of the other digits and not with the position of the epiphyses for the other metacarpals, thus suggesting the possibility that the first "metacarpal" is, in reality, a phalanx and not a metacarpal, and that in the evolution of the hand and foot there has been a loss of the first metacarpal for the first digit or thumb. This is an interesting problem in comparative anatomy and biologic evolution which may well form an independent thesis.

Case 3 The members of the family which we are about to discuss showed polydactyly as a dominant hereditary character. The mother had six well formed toes without evidence of syndactyly. The X-ray films showed five well formed metatarsals and an incompletely developed sixth. The first phalanges of the two great toes on each foot articulated with the first metatarsal. No phalanx articulated with the incompletely developed metatarsal.

This patient had six digits on each hand, the extra digit which was on the ulnar side of the little finger was shorter than the other fingers. Roentgenologically, this digit was seen to have two phalanges and an incompletely developed first phalanx (Figs. 6, 7, 8).

The daughter had seven digits on one foot and six on the other, apparently two well formed great toes on each foot, and each great toe articulated with its own metatarsal. In this respect the patient differed decidedly from the mother. On the left foot there were two well formed little toes, each articulating with a single metatarsal which was incompletely bifurcated in its distal 0.5 inch, giving the appearance of a fork thus forming separate articular surfaces for each first phalanx. On the right foot, each



Fig. 3 Case 1 X-ray film made two and one-half years after original operation for complete syndactyly.

of the six toes articulated with its own metatarsal.

The hands were identical. Each presented six digits with only five metacarpals. The sixth digit had no metacarpal of its own, but rested against the ulnar side of the fifth metacarpal (Figs. 9, 10, 11).

As surgeons, we are confronted with the problem of removal of the supernumerary toe or toes when the foot is too broad to be accommodated by the average shoe. In the case of the supernumerary digit on the fibula side of the little toe, there is little cause for discussion or doubt as to the proper procedure, but when it is a supernumerary great toe the question is one that requires study not only of the X-ray film, but also of the musculature of the respective toes. If the extensors and flexors are duplicated then it

does not matter, but if they are not, then one may, by chance, remove the wrong digit. This problem is more serious in the case of the hand if there are two thumbs, since the function of opposing the first digit, which

The left hand had a well formed thumb and two fingers which were completely united, and on the ulnar side of one of the fingers there was an angular deformity. On palpation this exhibited a blunt end and



Fig 4 Case 2 Syndactyly in a four-year-old child. The thumb has three phalanges

we call a thumb, to the other digits is entirely dependent on its particular musculature.

In view of the above facts this group of cases becomes of more than academic interest to the surgeon.

Case 4 J H, aged 20 years. The diagnosis was syndactyly, hypodactyly, ectromelia, and deficiency of the fibula (Figs 12, 13, 14).

Physical Examination—On Aug 5, 1930, examination showed the right hand to be very narrow. There was no evidence of a thumb. There were only two fingers, evidently a middle and ring finger, and there was complete syndactyly of these two. Apparently there were only two phalanges to both fingers. There were only two metacarpals palpable.

The patient was unable to make a fist completely. He was unable to grasp an object tightly, but, as the result of necessity, after flexing the interphalangeal joint he pulled backward on the forearm in order to hold the object.

seemed to give the impression of springing from the first phalanx. The unusual feature about it was the great length of the first phalanx of what seemed to be the index finger. While the index finger had three well formed phalanges, the other finger seemed to have only two, in other words, there seemed to be only one interphalangeal joint which I could make out. The first phalanx of the finger on the ulnar side was bifurcated near the distal end and had two articular surfaces. There were apparently two terminal phalanges.

The length of the index finger was 10 cm from the metacarpophalangeal joint to the tip, the length of the other was 8.5 centimeters. The length of the first phalanx of the index finger was 5 centimeters. The length of the right hand from the metacarpophalangeal joint to the tip of the finger was 6.5 cm, the other, not over 6 centimeters.

There was a marked deformity of the right lower extremity. The tibia was saber-

shaped and the foot was displaced laterally and backward so that the tibia was prominent on the inner side. There were only

to the upper epiphysis fused with the metaphysis, and a segment which corresponded to the lower epiphysis fused with the lower



Fig. 5 Case 2 The thumb with three phalanges

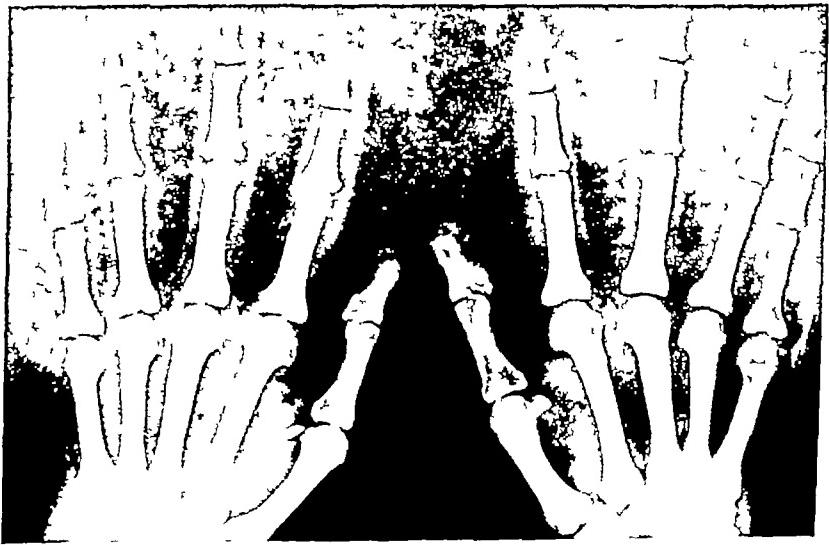


Fig. 6 Case 3 Polydactyly in the mother of 1 family which showed the anomaly as a dominant hereditary character

three toes and a great toe. There was no evidence roentgenologically of the midportion of the shaft of the fibula. There was a small segment of the fibula corresponding

metaphysis. The shaft was absent for the most part.

There was no deformity of the left leg, except that there were present only three

toes and a great toe. There was nothing suggestive of syndactylyism.

Unfortunately this patient disappeared after the examination was completed and it has been impossible to locate him.

Summarizing the clinical findings in this case there are certain conclusions which seem justifiable:

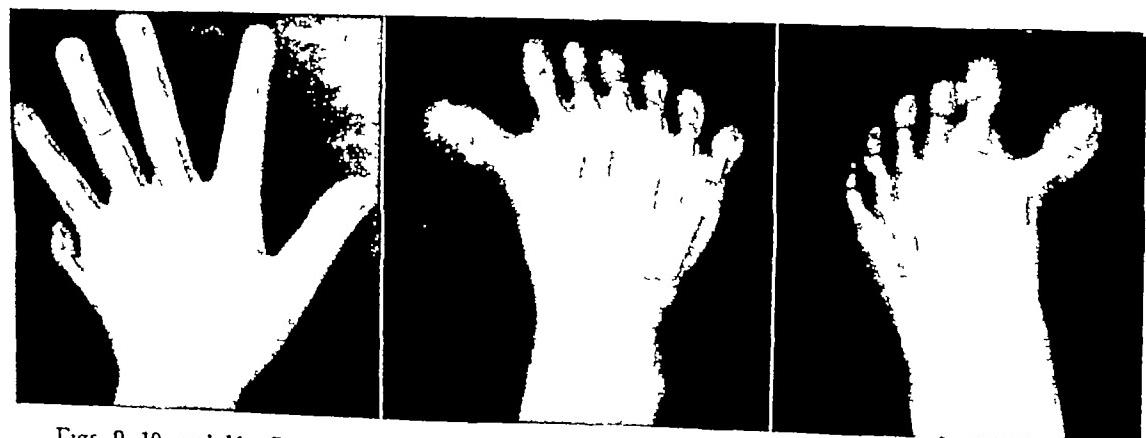
1. There is a definite hypodactylyism, more marked on the right than on the left.

2. There are only two fingers on the right hand and three on the left, with evidence of an arrested development which causes a bifid appearance of the terminal portion of one of the phalanges.

3. On the right hand there are only two carpal bones to be seen roentgenologically, thus we may say there is an absence of six carpal bones on the right, and on the left hand there seems to be a fusion of some of



Figs 7 and 8 Case 3. Films of the right and left feet, showing incompletely developed sixth metatarsal on each foot.



Figs 9, 10, and 11 Case 3. Feet and hand of daughter in family with hereditary polydactylyism. The hands were identical, each presenting six digits with only five metacarpals.

the carpals so that I can make out only three distinctly

4 There is an absence of the major portion of the shaft of the fibula. The upper and lower epiphyses appear, with a small

formed digit on the left hand was the thumb. There was a small bud which looked like an abortive attempt at a little finger. There was limitation of supination and limitation of flexion of the elbow.



Fig. 12 Case 4. The patient exhibited syndactyly, hypodactyly, deficiency of fibula, and ectromelia.

portion of the upper and lower portions of the diaphyses attached to them

5 There is a fusion of some of the tarsal bones on the right and a hypodactyl and syndactyl condition present in both feet

This case seems to bear testimony to the truth of the observations of Bagg and Stockard, that along with hereditary factors there must have been a developmental arrest responsible for the findings. The great variety of defects cited in this case could not well be accounted for in any other way.

Case 5 W P, age 9 years. The diagnosis was ectromelia (Figs. 15, 16, 17, 18)

Physical Examination—The entire upper extremity on the left was very much smaller and shorter than on the right. The only well

X-ray films were made of both shoulders, both elbows, and both hands.

This case is one of the most interesting of all the skeletal defects and disturbances that I have seen. We see that one of the upper extremities presents, at the shoulder and elbow, the appearance of at least one year's difference in skeletal growth. At the wrists there is even a greater divergence in the skeletal ages, the right wrist being that of a child of nine years, while the left appears that of a child between five and six years of age. Only one digit on the left hand has well formed phalanges. There are two distinct well-formed metacarpals and three that are rudimentary. The entire upper extremity on the left is shorter than on the right.

This case, I believe, can be explained only as a developmental arrest.

It would be futile to try to present cases from the literature as this would serve no useful purpose, not even for classification. Any attempt at classification except in a general way would be ridiculous. There are millions of possible combinations of defects and we might as well satisfy ourselves with the conclusions of Stockard "There is little reason for further description of individual monsters as all belong to the same class and the individual differences simply result from the different period during which the developmental interruptions have acted." Extensive articles have been written in all languages and these are referred to in the bibliography.

DYSCHONDROPLASIA

We come now to the phase of the subject which is most confusing and the conclusions at which I arrive are certainly in a controversial field. Even so, the suggestions which are here made may stimulate those well qualified to prove or disprove my statements.

I believe that the evidence which has been collected indicates that dyschondroplasia and other congenital deformities are identical in origin.

I have been especially impressed by the marvelous work of Jansen, and at the same time with the evident neglect of his important conclusions by many recent observers. Let me say at the outset that I believe with Jansen that dyschondroplasia is distinctly a dissociation phenomenon.

A careful study of his conception of the various factors involved in normal bone growth and the dissociation phenomena which give rise to exostoses cannot help but be profitable.

Before proceeding further it may be well to review the literature "Dyschondroplasia," "dissociation phenomena," "multiple epiphyseal chondromas," "exostoses" and

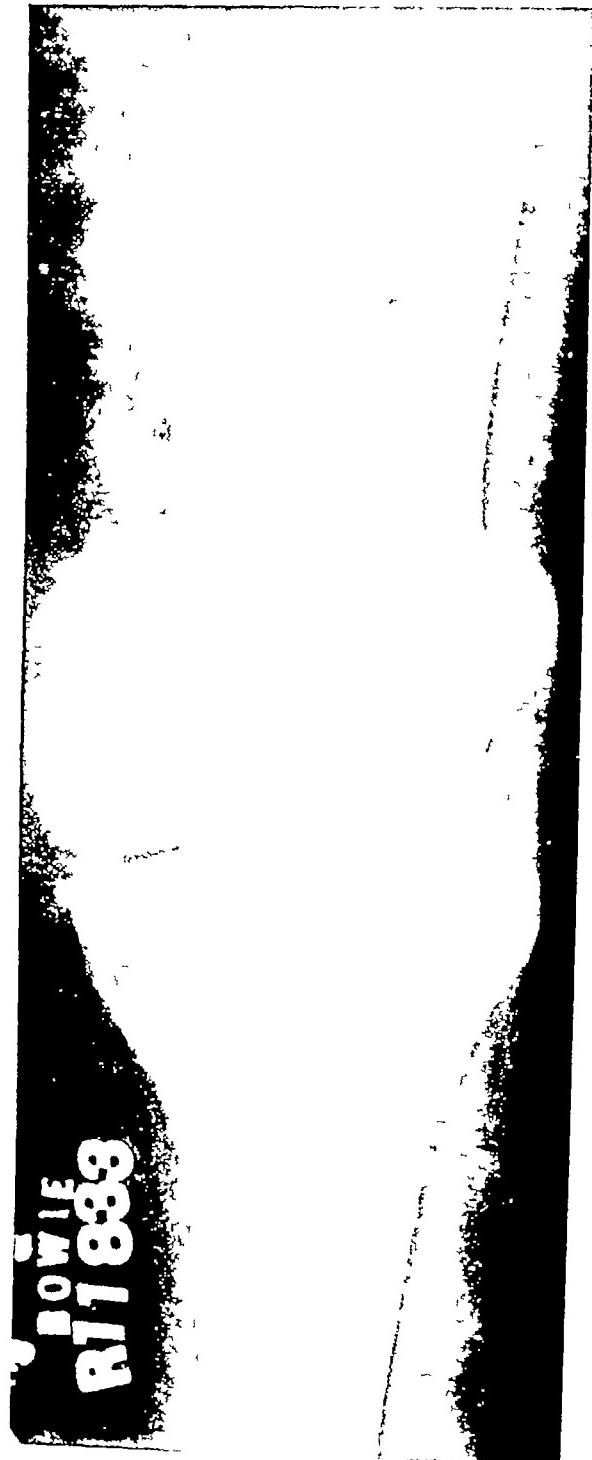


Fig. 13 Case 4 Defect in the fibula and absence

many other names have been used to describe a skeletal disturbance, reference to which is not uncommon in the literature. According to G. G. Davis the condition was

described by Caesar Hawkins in 1837. The first case to be reported in the United States was by Virgil B. Gibney (19) on March 24, 1875, when he presented at the New York Pathological Society a boy of 13 years who

Many of the earlier writers attempted to prove the association between multiple exostoses and achondroplasia. Jansen reports that Bessel-Hagen, in 1891, found that, almost without exception, patients who had



Fig. 14. Case 4. Radiograms give no evidence of the midportion of the shaft of the fibula.

had well marked exostoses on the upper end of each tibia and the proximal end of each humerus, and one on the left index finger.

Gibney again presented this patient before the same Society on April 23, 1897.

In 1876 he reported a Prussian family in which there were six members affected with the disease. These six patients represented three generations, one in the first generation, two in the second and three in the third generation.

multiple exostoses showed a stunting of growth.

Jansen also quotes Fischer, who described giant-growth in three members of a family who presented exostoses. Others, notably French authors, have described gigantism in cases of multiple exostoses. "Stunting of growth is not to be considered as a symptom associated with multiple exostoses."

In 1898, Ollier reported two cases of cartilaginous dystrophy in which the extremi-

ties of one side of the body were markedly retarded in growth, and to which he gave the name of dyschondroplasia. He defined dyschondroplasia as "an affection of the period of growth, with arrest of growing

view by partial arrest of development of the skeleton

2 The disturbance of the bony growth affects by preference the long bones of the extremities and the metacarpophalangeal skeleton of the hand

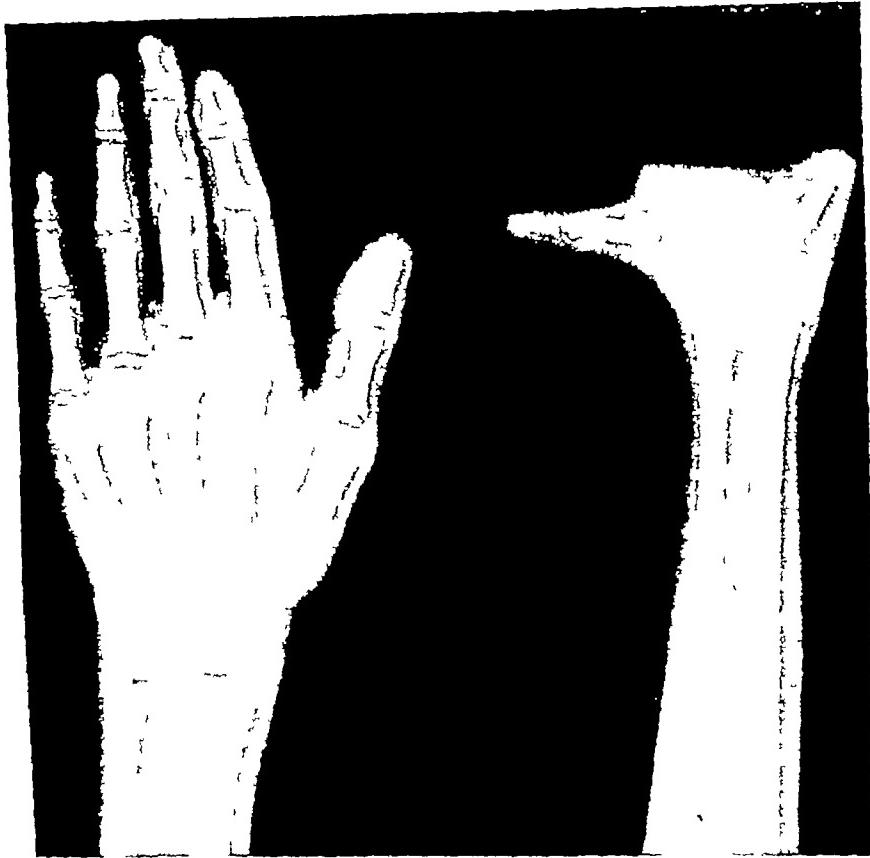


Fig. 15. Case 5. Ectromelia in a nine-year-old patient. Great divergence in the skeletal ages is shown, the right wrist being that of a child of nine, and the left having the appearance of that of a child of from five to six years old.

parts of the skeleton, with nodosities and swellings of the extremities of the corresponding long bones, curving of diaphyses and slight but constant deformities of the hands." He considered one-sidedness characteristic of the disease.

In 1910, Molin, a pupil of Ollier, published a thesis at Lyons entitled "Dyschondroplasia." His conclusions were

1 Dyschondroplasia is an osseous dystrophy characterized from a clinical point of

3 The long bones show curvatures analogous to those of rickets

4 Joint deformities must be considered as the direct consequence of bony alterations

5 Only the roentgenograph allows the nature of the dystrophy to be observed, it approaches that of rickets and chondroma but does not completely simulate them

6 The definite isolation of this condition cannot be made on account of the absence of complete microscopic findings

7 The identity of dyschondroplasia and



Fig 16 Case 5 Right shoulder



Fig 17 Case 5 Left shoulder Comparison of this view with Fig 16 shows the difference in skeletal growth when compared with the right shoulder

osteogenic exostoses needs further pathologic-anatomic control

8 The etiology is absolutely unknown
(Quoted from Cole)

It should be noted that Mohn and Ollier suggested a partial arrest of the development of the skeleton and that the identity of dyschondroplasia and exostoses needed further investigation. When one considers that this was thirty-one years ago, it is rather interesting to note that such an early lead was not followed up. While it is true that others in America have discussed the disease and reported individual cases, the excellent review of the literature by Ehrenfried, in 1915, has been most extensively quoted by subsequent writers. He was able to collect over three hundred articles representing about 600 cases, the majority of

which had been reported by German, French, and English writers. Up to that time Ehrenfried was able to find only 12 cases which had been reported in America.

Ehrenfried (15) stated, "A great deal has been written about the pathology and much confusion exists at the present time [1915]." This confusion he believes to be due to the fact that "most of the theories date to pre-*roentgen* days, and that the attention of the pathologists has been directed toward the relatively unimportant exostosis, rather than to the intermediary cartilage at the epiphyseal line." He believes that the theory of the inheritance of a faulty anlage for the bone-producing intermediary cartilage is still accepted. He states, "The disease consists, in brief, of a disturbance in the process of proliferation and ossification at the intermediary cartilage during the period of skeletal growth."

Comment.—Note that Ehrenfried considered that the disturbance occurred during the period of growth. My thesis is that the arrest occurs prior to birth and manifests itself during the growth period.

When discussing the characteristics of the disease Ehrenfried states

The skeletal disturbance and malformations are generally symmetrical for the two sides of the body. The affection is distinctly one of the period of skeletal growth. Manifestations increase with skeletal growth and cease with



Fig 18 Case 5 The difference in skeletal growth is shown by X-ray films of the elbows

maturity. Generally the cases have shown irregular juxta-epiphyseal hyperostoses, particularly marked at the knee, hip, shoulder, ankle, and wrist. The lower end of the femur and the upper end of the tibia have shown a characteristic squaring off, with spurs at the corner, running upward from the femur and downward from the tibia.

H. W. Marshall (30) made no attempt to discuss the theories of origin for, he says, "None can be proved beyond question. No observations have been made that are antagonistic to Ehrenfried."

Ashurst states, "The underlying pathologic change in cases of this sort is a chondrodysplasia affecting the metaphyses of the long bones, with the exostoses being merely incidental and not the essence of the disease" (*Quoted by Cole*)

After reporting a personally observed case and reviewing the literature Cole concludes

1 'Ollier's disease' is a term which seems fixed in the literature but which should be used to designate only those cases of cartilaginous dystrophy with or without cartilaginous tumor or exostosis formation, which show an asymmetrical involvement of the body as the outstanding clinical feature.

2 'Chondrodysplasia' (a term preferable to 'dyschondroplasia') is a condition which is usually asymmetrical but as several symmetrical cases are on record the term must, therefore, be broader in its application than 'Ollier's disease.'

The gradation of reported cases between those of frank multiple cartilaginous exostoses, on the one hand, and the so-called chondrodysplasia with no change in anything but the internal architecture of the bones (Voorhoeve cases), on the other, is so varied and irregular that a definite classification of cartilaginous dystrophy is still impossible. The possibility that the apparently widely different findings in some of these cases are only manifestations of different stages of the same condition must not be overlooked.

It should be remarked that Cole would

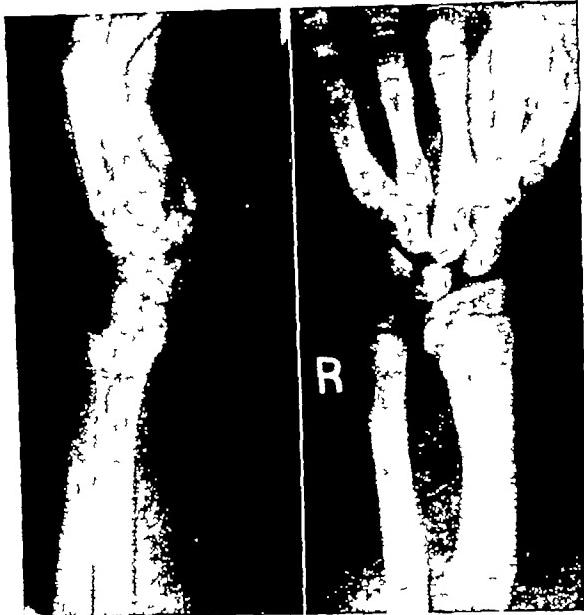


Fig. 19 Case 6 Dyschondroplasia accompanied by marked bowing of the forearm, which was more noticeable on the dorsum of the forearm when it was pronated (Film made in 1921)

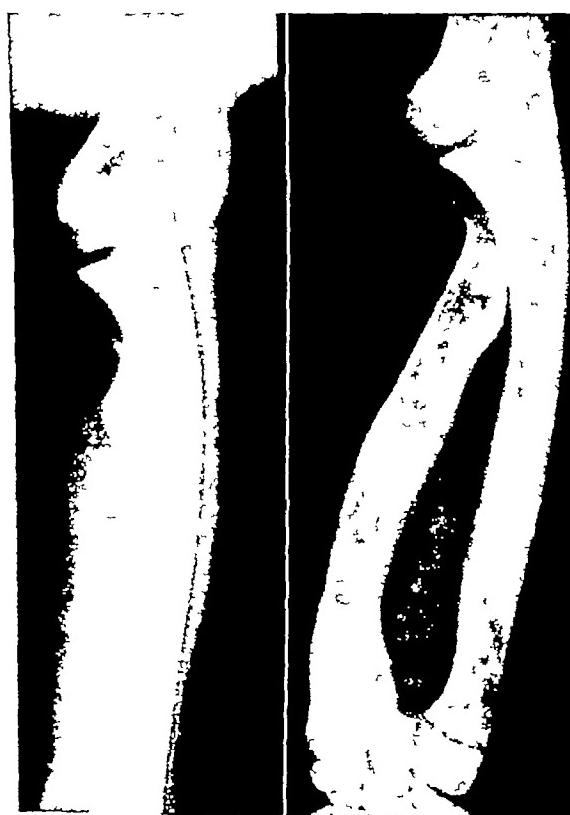


Fig. 20 The same case, from an X-ray film made in 1926

restrict the use of the name "Ollier's" to an asymmetrical skeletal retardation. It is interesting to note particularly Cole's final conclusions in which he speculated about that which seems to have been conclusively proved by Jansen's more recent work.

Sir Arthur Keith (26) stated

Multiple exostoses is usually placed by surgeons in the category of tumors, but a close examination of anatomic changes shows that it should be definitely placed among the disorders of growth and given a name to indicate its true nature. The name I propose, one suggested to me by Mr. Morley Roberts, is 'diaphyseal aclasis,' because the main incidence of the disturbance falls upon the modelling or pruning of the diaphyses or shafts of bones.

Characteristically, Sir Arthur Keith was able to find in his industrious researches that John Hunter had laid the foundation for what seems to be to-day the most logical conception of this condition.

Quoting Sir Arthur Keith

One of John Hunter's more important discoveries was his realization that the shafts of new bone grew in length by a double process; there was first the deposition of new bone in the cartilaginous growth disc at the ends of the shaft, a process clearly recognized before Hunter's time, there was in the second place 'a modelling process' by which the new bone thus laid down was pruned, reformed, and incorporated as an intrinsic architectural part of the cylindrical shaft. Hunter clearly recognized that these two processes were independent operations. If Hunter's teaching is true, then we ought to find disorders of growth in which deposition of new bone goes on while the second, or remodelling, process is retarded or even completely arrested. A survey of the skiagrams of the first case of multiple exostoses that came my way showed me that in this disorder the deposition process goes on, but the modelling process is retarded and aberrant. In multiple exostoses, which is

a disorder of youth and of adolescence, then, the modelling process is profoundly retarded, in some instances almost arrested. The bony excrescences, or tumors, which serve as diagnostic marks for the clinical recognition of the condition, are merely secondary results of the primary disorder of growth for which I propose the name of 'diaphyseal aclasis.'

Bentzen, in 1924, concluded

Ollier's disease represents the typical reaction of the bones against certain disorders in the innervation of their blood vessels. It is often confined to one-half the body. Masses of hyaline cartilage are found to follow paths similar to those of the arteries of the bones. The pathologic processes in the bone tissue may be assumed to be related to the formation of callus in a fracture in which the blood vessels have been interrupted. (*Quoted from Cleveland, 7*)

Cleveland stated

Bentzen disagrees with Ollier and Wittek, who described the disease as a disturbance of epiphyseal growth. He regards this as a secondary phenomenon. The primary focus is, he believes, in the diaphyses, which are nourished by a single large nutrient artery. From an experimental standpoint, working with rabbits, he was able, by interrupting the sympathetic nerves, in some instances to produce structural changes in bone similar to those seen in Ollier's disease. Bentzen's theories of the etiology of Ollier's disease, supported by his studies, form a valuable contribution.

In 1910 Gossage and Carling (22) emphasized the hereditary nature of the condition. The confusion which existed at that time with regard to the condition is illustrated by the following statement quoted from Gossage and Carling: "There is undoubtedly some relationship between cartilaginous exostoses and multiple enchondromas and of both with the peculiar disturbance of growth described by Ollier and known as 'dyschondroplasia'."

From the above it can be seen that those authors looked upon the condition as three separate entities, but with some relationship

In 1913, Thomas R Boggs (4) discussing multiple congenital osteochondromas, stated "There is much reason to accept the view that these tumors are truly congenital and due to abnormal anlage in the intermediary cartilage (*von Bergmann*)"

In 1915, R D Carman and A O Fisher (6) also accepted the theory expressed by von Bergmann Quoting from their work we find "The general involvement of the epiphyses, with the relative freedom from involvement of the shafts, is very striking and seems to support the most plausible theory advanced by von Bergmann and others with reference to the etiology of this condition, namely, that the lesions arise in abnormal anlage in the intermediary cartilage"

Again in 1925 Horace E Campbell (5) expressed the belief that "the most probable explanation is that there is a disturbance in development of the intermediate cartilage due to an original defective anlage" He further states that there is "little known concerning the etiology"

In 1930, Olan R Hyndman (23) stated

Like practically all of the hereditary disease entities of the skeleton, the etiology of chondrodyplasia remains a mystery

Although the primary factor is not established, it would seem to me that at least one fact is tenable and clear, that cartilage rests are left in the wake of a chaotic advancing epiphysis, and these rests undoubtedly form the nucleus of the anomalous benign tumors

Up to this time very little attention had been paid to the work of Murk Jansen and of Sir Arthur Keith, and, with the exception of Keith's brief mentioned statements of John Hunter, little or no attention was paid to the undeveloped ideas of dissociation of bone growth to which John Hunter gave a definite clue Great credit is due Jansen,

and his views should be more generally accepted I believe many of the conditions which to-day are considered separate entities will probably eventually be included under retardation phenomena after the significance of Jansen's work is more generally appreciated It is difficult to abstract this study briefly and for that reason I will quote rather extensively from the original surgical essay which appeared in the Jones Birthday Volume

Jansen states

Six different processes, and probably more, have to co-operate harmoniously in order that the bones shall attain their proper size, shape, structure, and composition when completing their growth These processes are resorption, tubulation (*i.e.*, the transformation of metaphysis into diaphysis), cancellation (*i.e.*, the formation of cancellous tissue), cell division, cell enlargement, and differentiation Sometimes one or more of these processes will be delayed with regard to the other processes during a shorter or longer period, *i.e.*, dissociates itself from those processes And the dissociation of each of these processes evokes its own characteristic symptoms which for the present may be concisely stated in the tabulation on the following page

The cause of dissociation of growth probably lies in disturbance of the sympathetic nervous system, through which either a defect or an excess of elements for bone growth is furnished

The clinical picture, according to Jansen, is characterized by its extreme polymorphism In some cases only a single bone is found to be affected and in others the condition presents itself on both sides I mention this statement because in one of our cases the retardation phenomena are limited to a single bone, the radius on one side, and in the other cases there is evidence of retardation phenomena in almost all of the bones of the skeleton, except the skull and vertebræ

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| | Causes |
|---|---|
| Dissociation (through retardation) | |
| Of resorption, e.g., of the tuberosity of the ribs, of the trochanters, the obturator borders of the ischial and pubic bones, or also in the meatus auditorius externus | Exostoses Too wide ischial and pubic bones (a two small obturator foramen) |
| Of tubulation | |
| (a) Over the whole circumference of | (a) Lengthened metaphyses |
| (b) Over part of the circumference | (b) Exostoses |
| Of cancellation | Striated and mottled metaphyses |
| Of cell division | |
| (a) Over the whole area of the growth cartilage | (a) Thin, eventually, invisible, discs and shortened bones |
| (b) Over part of the area of the growth cartilage | (b) Obliquely situated or cone- or cupola-shaped, irregular growth discs with varus-valgus flexion or hyperextension positions of the long bones. |
| Of cell enlargement (?) | |
| Of cell differentiation | Chondroma, enchondromas, giant-cell tumors, i.e., dissociation tumors |

Jansen emphasizes that any symptom may predominate in the clinical picture and "The symptoms may be associated with the other symptoms in every conceivable combination and in every imaginable locality though only in the bones formed in cartilage"

PATHOGENESIS

Discussing pathogenesis Jansen says

It should be remembered that during the growth of bone, resorption of the metaphyses has to keep pace with longitudinal growth

During growth the epiphysis is displaced distally by the growth disc, the metaphysis is not. The processes of resorption of the cancellous tissue and its transformation into the compact diaphyseal tube we will call 'tubulation of the metaphysis' or, shortly, 'tubulation'. It stands to reason that only if the tubulation keeps pace with the longitudinal growth of the bone will the normal funnel shape of the diaphysis end lie close to the epiphysis, whereas an approximately cylindrical area of cancellous tissue produced by the growth disc must be expected to lie between the funnel-shaped end of the metaphysis and the growth cartilage, when tubulation is retarded. Hence, the conclusion presents itself that the cylindrical or barrel-shaped area between the growth cartilage and the funnel-shaped metaphysis, which we will call 'lengthened metaphysis,' is caused by a retardation or tubulation, i.e., by a dissociation of tubulation

from the processes of longitudinal growth through either relative or absolute retardation

What causes the local impediment to tubulation is as yet unknown

Taking everything into consideration, we cannot help believing that the lengthened metaphysis is the result of a retardation of tubulation over the whole periphery of the bone, i.e., a total retardation of tubulation, and the exostoses a partial retardation of tubulation, i.e., these two phenomena appear to us as the result of a total and a partial dissociation through retardation of tubulation with regard to the other processes of longitudinal growth

Virchow, Ollier, and all other authors, as well as ourselves, consider enchondromas to be caused by the failure of one of the growth processes, viz., by what in the above has been termed 'dissociation of one of the growth processes through retardation with regard to the others'

According to Virchow, exostoses are caused by a stimulation of the growth cartilage which evokes undue lateral growth

There is no denying that the picture of the development of exostoses sketched by Virchow is anything but clear. 'Stimulation [by what?] of the growth cartilage' causes 'undue [why?] lateral [why and how?] growth'. If this were correct, this cartilage would have to start its growth from the side opposite to that from which it grows normally

We are tempted to assume that each of the processes of bone growth may be retarded with regard to the others, either over the

whole area of its activity in a bone (total dissociation) or in part of it (partial dissociation), each dissociation leading to characteristic phenomena

Total retardation of cell division in a growth disc causes thinning of the growth disc, shortening of the bone, and trumpeting of the metaphysis,

Partial retardation of cell division causes deformations of obliquity of the growth disc and deformities in the bone,

Total retardation of differentiation causes cartilaginous metaphysis,

Partial retardation of differentiation causes clear areas in the bones. Both total and partial retardation may form tumors (dissociation tumors),

Retardation of cancellation causes gross longitudinal striation—and, possibly, also dense stippling (?),

Total retardation of tubulation leads to lengthened metaphysis,

Partial retardation of tubulation leads to the development of exostoses, whilst

Retardation of resorption leads to the development of widened bones, enlarged apophyses, and probably also of button-shaped exostoses on the ribs

Geschickter (18), in a recent contribution, discusses dyschondroplasia, saying

The fundamental basis of the congenital disturbance is obscure, but deficiencies in the periosteum and a tendency for the perichondrium to persist and to function as such, together with precartilaginous connective tissue about the joints, seem to be responsible for most of the deformities. The process is extremely complicated but it shows what a fine state of balance among various tissues of similar function is necessary to produce the normal

One will note from the above quotation that Geschickter comes very close in his conclusions to those of Jansen, but apparently he feels still uncertain about the underlying cause. However, his realization that there is a fine balance among various tissues and



Fig. 21 The same case as shown in Figures 19 and 20, from a film made in 1927

similar functions necessary to produce normal shows a definite leaning toward Jansen's conclusions

Wahren's (44) clinical experience appears to support and illustrate clearly the theory of Murk Jansen. Wahren states

The exostoses and the elongation of the metaphyses are co-ordinated symptoms which develop through an inhibition of that process which effects during growth a metamorphosis of the metaphysis into diaphysis. This process is termed 'tubulation' by Murk Jansen

This brief summary of the literature justifies, I believe, certain conclusions

1 Dyschondroplasia and other congenital deformities are identical in origin

2 Dyschondroplasia is evidence of retardation or dissociation phenomena in bone growth. Such phenomena may be partial

DYSCHONDROPLASIA

The first case to be presented is of particular interest because the manifestations of the "disturbance" are limited to one bone.

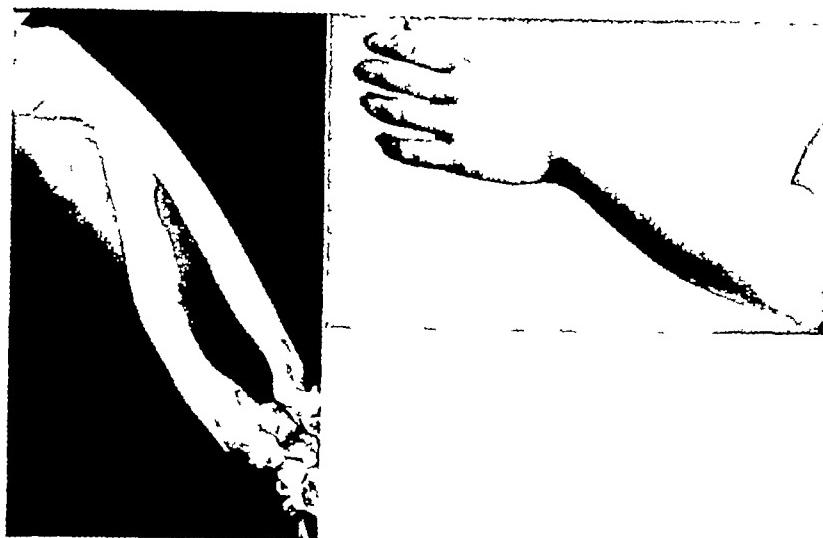


Fig. 22 (left) The same case, from a film made in 1931. There has been complete union between the epiphysis and the diaphysis at the lower end of the radius.

Fig. 23 (right) Case 6. The photograph was made five years after the original observation. The disturbance was limited to a single bone.

or complete. Partial retardation of tubulation leads to exostoses. Total retardation of tubulation leads to long, wide metaphyses.

3 Dyschondroplasia may be limited to a single bone or it may involve almost all of the bones of the skeleton. We have seen involvement of all long bones, and the scapulae, ribs, and pelvic bones as well. It may manifest itself in shortening, bending, or widening of the metaphyses and exostoses.

4 The theory advanced by Jansen explains all of the phenomena which are found.

5 The clinical experience which we have had adds to the weight of evidence in favor of Jansen's theory.

CLINICAL REPORT

The following summaries of cases which we have observed are here presented.

This case is of interest when we compare it with the description of the cases which are to follow. In our other cases we have an almost universal evidence of retardation of tubulation or dissociation phenomena. In this case we have the dissociation phenomena limited to a single bone. In the succeeding cases, dissociation phenomena were both complete and partial, evidenced by the formation of exostoses, as well as long metaphyses. In this case there were no exostoses, but just a retardation of tubulation.

It is comparatively easy at this time to classify this case, but as will be seen from my original notes, rickets, osteitis fibrosa, and endocrine disturbances were considered, only to be finally abandoned. While it may seem rather far-fetched, I believe it, nevertheless, worth while mentioning as a precaution that the absence of a febrile reaction

and other evidences of infection should certainly make one avoid the error of suggesting osteomyelitis as a diagnosis. Giant-cell tumor might possibly have been offered as a diagnosis and the patient operated upon unnecessarily.

The explanation offered by Jansen, I believe, clearly places this case in the category of dissociation phenomena.

Case 6 E A, age 13 years, was first observed on Oct 7, 1926. The diagnosis was dyschondroplasia (Figs 19, 20, 21, 22, 23). There was no history of a definite injury. There was pain in the left wrist, particularly when carrying heavy objects. The child had never stopped her ordinary activities except that her left wrist tired when she was practising on the piano. The condition for which she consulted me had first been noticed about five years before the present examination, at which time she had been taken to another physician.

Physical Examination—The patient is a well developed and well nourished female child, height 4 ft 8 inches. There was nothing unusual to be noted about the contour of the face, the teeth were in excellent condition and no prognathism was noted. The contours of the shoulders were identical. There was no limitation of motion of either shoulder, no noticeable deformity of the scapulae was found.

Examination of the elbow revealed that the carrying angle on the right side was normal. There was a diminished carrying angle on the left, with a deviation to the ulnar side. There was marked bowing of the forearm about two inches above the wrist, which was more noticeable on the dorsum of the forearm when it was pronated. There was a prominence in the antecubital fossa. There was some atrophy of the thenar and hypothenar eminences, and the muscles of the fingers. Palmar flexion was increased, dorsiflexion was limited.

The lower extremities were the same length by actual measurement. The great

trochanters were apparently on the same level. There was no bowing of either thigh or leg, and no limitation of motion of the hip, knee, or ankle on either side.

The blood calcium was 10.5 mg for 100 cc of blood, and the phosphorus content was 0.95 mg for 100 cc of blood. The Wassermann test was negative.

The X-ray films showed a marked bowing of the left radius, the lower portion of the shaft being broader than its fellow. The lower epiphysis of the radius, instead of being transverse, was oblique and irregular. The radiologists (E C Samuel, M D, and E R Bowie, M D) reported "The condition is strongly suggestive of dyschondroplasia."

The appearance was so unusual that Dr. Samuel and Dr. Bowie suggested they would like to have the opinion of another radiologist. Accordingly they sent the films to a distinguished radiologist in a distant city who suggested that the condition was probably a Madelung's deformity.

I advised the mother that I did not believe this to be a Madelung's deformity, but I thought it to be associated with a nutritional disturbance, probably a late rickets or an osteitis fibrosa cystica. Further, I advised her that, if the disease progressed, it would be wise for her to consult either Dr. Joseph Bloodgood, of Baltimore, or Dr. Dallas Phemister, of Chicago.

Following up the idea which we originally expressed, the patient was given a diet rich in calcium and phosphorus, and general body irradiation. She showed no improvement, but there was no progress of the deformity and no other bone of the skeleton became involved. After a short time the treatment was discontinued as I did not believe that we were obtaining any benefit.

From time to time radiograms have been made, the last one in September, 1931. There has been a complete union between the epiphysis and the diaphysis at the lower end of the radius. If we are to take the

1 Dyschondroplasia and other congenital deformities are identical in origin

2 Dyschondroplasia is evidence of retardation or dissociation phenomena in bone growth. Such phenomena may be partial

DYSCHONDROPLASIA

The first case to be presented is of particular interest because the manifestations of the "disturbance" are limited to one bone

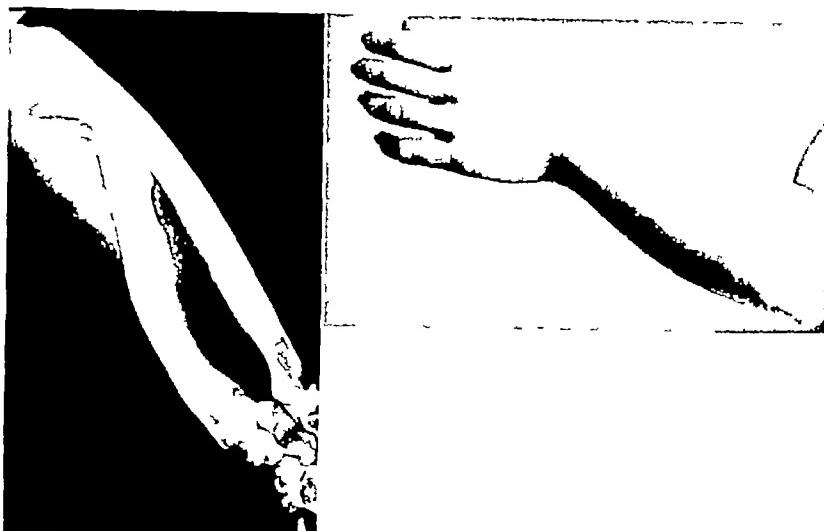


Fig. 22 (*left*) The same case, from a film made in 1931. There has been complete union between the epiphysis and the diaphysis at the lower end of the radius.

Fig. 23 (*right*) Case 6. The photograph was made five years after the original observation. The disturbance was limited to a single bone.

or complete. Partial retardation of tubulation leads to exostoses. Total retardation of tubulation leads to long, wide metaphyses.

3 Dyschondroplasia may be limited to a single bone or it may involve almost all of the bones of the skeleton. We have seen involvement of all long bones, and the scapulae, ribs, and pelvic bones as well. It may manifest itself in shortening, bending, or widening of the metaphyses and exostoses.

4 The theory advanced by Jansen explains all of the phenomena which are found.

5 The clinical experience which we have had adds to the weight of evidence in favor of Jansen's theory.

CLINICAL REPORT

The following summaries of cases which we have observed are here presented.

This case is of interest when we compare it with the description of the cases which are to follow. In our other cases we have an almost universal evidence of retardation of tubulation or dissociation phenomena. In this case we have the dissociation phenomena limited to a single bone. In the succeeding cases, dissociation phenomena were both complete and partial, evidenced by the formation of exostoses, as well as long metaphyses. In this case there were no exostoses, but just a retardation of tubulation.

It is comparatively easy at this time to classify this case, but as will be seen from my original notes, rickets, osteitis fibrosa, and endocrine disturbances were considered, only to be finally abandoned. While it may seem rather far-fetched, I believe it, nevertheless, worth while mentioning as a precaution that the absence of a febrile reaction

and other evidences of infection should certainly make one avoid the error of suggesting osteomyelitis as a diagnosis Giant-cell tumor might possibly have been offered as a diagnosis and the patient operated upon unnecessarily

The explanation offered by Jansen, I believe, clearly places this case in the category of dissociation phenomena

Case 6 E A, age 13 years, was first observed on Oct 7, 1926. The diagnosis was dyschondroplasia (Figs 19, 20, 21, 22, 23). There was no history of a definite injury. There was pain in the left wrist, particularly when carrying heavy objects. The child had never stopped her ordinary activities except that her left wrist tired when she was practising on the piano. The condition for which she consulted me had first been noticed about five years before the present examination, at which time she had been taken to another physician.

Physical Examination—The patient is a well developed and well nourished female child, height 4 ft 8 inches. There was nothing unusual to be noted about the contour of the face, the teeth were in excellent condition and no prognathism was noted. The contours of the shoulders were identical. There was no limitation of motion of either shoulder, no noticeable deformity of the scapulae was found.

Examination of the elbow revealed that the carrying angle on the right side was normal. There was a diminished carrying angle on the left, with a deviation to the ulnar side. There was marked bowing of the forearm about two inches above the wrist, which was more noticeable on the dorsum of the forearm when it was pronated. There was a prominence in the antecubital fossa. There was some atrophy of the thenar and hypothenar eminences, and the muscles of the fingers. Palmar flexion was increased, dorsiflexion was limited.

The lower extremities were the same length by actual measurement. The great

trochanters were apparently on the same level. There was no bowing of either thigh or leg, and no limitation of motion of the hip, knee, or ankle on either side.

The blood calcium was 10.5 mg for 100 cc of blood, and the phosphorus content was 0.95 mg for 100 cc of blood. The Wassermann test was negative.

The X-ray films showed a marked bowing of the left radius, the lower portion of the shaft being broader than its fellow. The lower epiphysis of the radius, instead of being transverse, was oblique and irregular. The radiologists (E C Samuel, M D, and E R Bowie, M D) reported "The condition is strongly suggestive of dyschondroplasia."

The appearance was so unusual that Dr Samuel and Dr Bowie suggested they would like to have the opinion of another radiologist. Accordingly they sent the films to a distinguished radiologist in a distant city who suggested that the condition was probably a Madelung's deformity.

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From time to time radiograms have been made the last one in September, 1931. There has been a complete union between the epiphysis and the diaphysis at the lower end of the radius. If we are to take the

postulates of Molin as a basis for classification, the bowing and shortening of the radius, the obliquity of the epiphysis, the lack

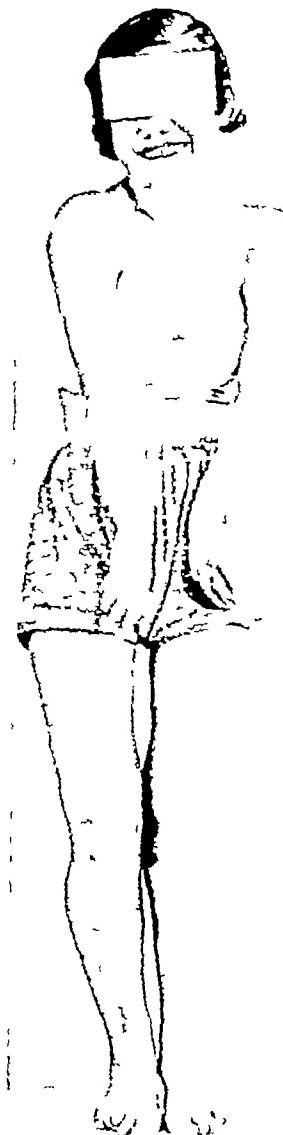


Fig. 24 Case 7 Dyschondroplasia. The nodules are widely distributed over the skeleton. Note the marked bowing of the right forearm and the shortening of the ulna.

of tubulation of the lower end of the metaphysis, and the vacuolization definitely place this case in the group of dyschondroplasia.

Case 7 J C, age 18 years The diagnosis was dyschondroplasia (Figs 24, 25, 26, 27, 28, 29, 30) This report is as of October, 1931

Clinical History—The patient was first seen on May 18, 1921, at which time the following notes were made. From the time the child was three years old, the mother had noticed small nodules near all of the large joints. In every other respect the child seemed perfectly well.

On examination we found widely distributed over the skeleton many large, hard, circumscribed, nodular masses, which were neither adherent to the skin nor tender to the touch. The large nodules were located on the left leg, in the region of the external malleolus, on the right leg, just above the internal malleolus, over the right ulna, in the region of the styloid process, over the left radius and ulna, and a small spur-like mass in the region of the right shoulder.

On account of the great number of masses which were present I advised removal of only those which interfered with function.

Operation—On Oct 7, 1921, the first operation was performed, consisting of linear incision on the inner side of the left knee, the upper limit corresponding to the epiphyseal line of the tibia. Care was taken not to injure the insertion of "hamstrings". Periosteal incision was made and a periosteotome was inserted between the growth and the shaft. The mass was elevated easily and removed *in toto*.

Incision was made along the lower third of the radius midway between the flexor and extensor tendons. The radial nerve came into view very readily and was retracted. The extensor longus pollicis was retracted to the dorsum of the forearm. After retracting the flexor muscles, the periosteum was incised and a periosteotome was inserted between the growth and the radius, and the growth removed. We then found a second growth on the dorsum of the radius which

we removed A small enchondroma on the index finger was removed

On Aug 4, 1922, a second operation was performed An incision about two inches long was made about the external malleolus of the left leg An enchondroma about one and one-half inches in length was easily removed, the only thing necessary was to lift it from the shaft of the fibula by means of a periosteotome

A small incision was made over the dor sum of the right foot, corresponding to the third metatarsal, and a small enchondroma was removed

The girl continued under observation and it was not until 1930 that she noticed an interference with walking because the masses about the lower end of the right tibia had increased markedly in size At that time (August, 1930) a series of X-ray films was made

These films showed that the metaphysis of the upper end of the right humerus ex tended from the level of the anatomic neck to the junction of the middle and upper third of the shaft On the outer side of the region of the great tuberosity there was a large vacuolated mass which was of less density than the normal shaft The upper third of the left humerus showed a marked vacuolization, with a large spur-like mass about two inches below the upper end of the metaphysis The radiogram of the pelvis showed a large mass springing from the posterior iliac crest This mass was much less dense than the remainder of the ilium There was a bilateral coxa vara Each femur had a short neck, and an increased transverse axis of the intertrochanteric line, giving the impression of an interference with tubulation

The films of the knees show wide metaphyses, marked vacuolization, and a large spur-like mass springing from the inner aspect of both femora, about the level of the adductor tubercle There was a wide metaphysis and marked vacuolization of the

upper end of the fibula, with a small spur-like projection on the upper aspect of the metaphysis of both tibiae

There was marked widening and lack of



Fig 25 Case 7 Posterior view, showing the multiple lesions

tubulation of the lower metaphysis of the tibiae, and sessile, spur-like formations Similar evidences of deformity were noted in the metatarsals

The right forearm showed a marked bowing of both radius and ulna with shortening of the ulna

At the time that these films were made, the mass about the right ankle was beginning to interfere with function and the patient was advised to submit to operation

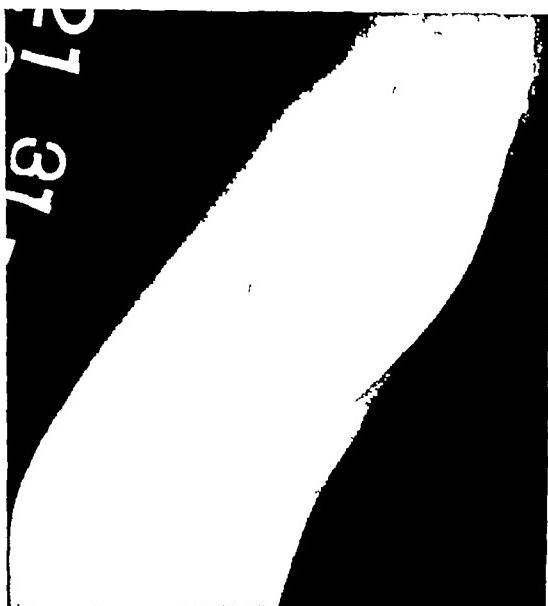


Fig. 26 Case 7 Dyschondroplasia. The film shows marked bowing of both radius and ulna with shortening of the latter.

She was seen again in January, 1931, and at that time the following notes were made:

Growth is stunted, the patient is only five feet tall.

Both upper extremities seem to be short, especially the forearms.

On the outer side of the right arm there is a large mass which extends down for about three inches. This mass is hard and nodular, and the skin which is freely movable over it, is not glossy.

On the left side of the median line, approximately at the level of the sixth dorsal vertebra, there is a mass about one inch in diameter which seems to spring from one of the ribs. Like other lesions, it is fixed, nodular, and has a bony hardness.

On the angle of the scapula, on the left side, there is a similar nodular mass. None of the masses is painful.

On the crest of the left ilium there is a mass about three inches by two inches. This lesion has all the characteristics mentioned before except that it is very much larger than the others.

On both sides of the left leg below the knee there are similar masses. There is a scar on the outer side of the left knee indicating the site of a previous operation. On the inner side of the left knee, there is a bony lesion.

The mass on the outer side of the right leg which extends into the popliteal space is one of the largest that she has.

In front of the right ankle there is a large lesion which is causing limitation of motion.

In June, 1931, the following operation was performed. Incision about three inches in length was made over the anterior inner aspect of the right leg, just above the ankle. The muscles were retracted and a hard, bony mass with multiple bosses on its surface was then seen. With a Campbell gouge and mallet, the bony growth was cut away from the tibia. Incision was made over the ulnar side of the right forearm and a mass similar to the one on the leg was removed in a like manner.

On Sept. 2, 1931, the patient returned for examination and the following notes were made:

The contour of the right leg is markedly improved, in fact, the anterior aspect of the lower third of the leg is perfectly straight. She is able to stand on her toes and at the present time there is no limitation of motion in either ankle.

The deformity about both shoulders, and the crest of the ilium is such that I have advised operative intervention in these regions.

Up to the present time I have removed seven of the masses because they were interfering with function.

Comments.—In making the diagnosis, multiple cartilaginous epiphyseal enchondromas, I was conforming with the commonly accepted term. It becomes immediately apparent, as one looks at the films of this patient's skeleton, particularly the humeri, femora, and tibiae, that these outgrowths, which like spurs interfere with

joint function, represent but a small part of the disturbance in growth and development of the pathologic process I use the expression "pathologic," not in the sense of disease but in the sense that there is a lack of

theory based on disturbance of the endocrine system, but no detailed satisfactory explanation, so far as I know, had before appeared Dissociation phenomena due to a complete retardation of the process of tubulation re-



Fig 27 Case 7 A large mass in the region of the right tuberosity and upper third of the left humerus

harmony among the various processes which have to do with normal bone growth

The fact that these lesions are multiple shows their relationship to something which has to do with abnormal development

These lesions are benign in the sense that they do not endanger life, but malignant in the sense that they are disabling and deforming We take them off if they begin to interfere with function We must not attempt to do too much during the early period of growth because of the danger of early bony union of the metaphysis and epiphysis which would interfere with growth in length of the skeleton Except with the pedunculated masses, no attempt to interfere surgically is advisable

All ideas of which I had knowledge, prior to the appearance of Murk Jansen's epoch-making study, did not seem to explain satisfactorily the wide metaphyses His explanation clearly accounts for every phenomenon which one sees in such cases It is true that John Hunter had paved the way and that Sir Arthur Keith had developed a

sult in a wide metaphysis, and partial retardation of tubulation causes exostoses

This last statement is verified by the last case of the series

Case 8 Miss B, 20 years old Diagnosis was dyschondroplasia. History—Ten years earlier she had noticed a small, hard mass about 0.5 inch in diameter on the right scapula A little later she noticed similar small bony masses on the inner aspect of the left thigh and the left leg just above the ankle Four years later she noticed a growth on the left side of the chest under the breast One year later a mass appeared on the inner aspect of the right leg just below the knee During the five years previous to examination, the patient had noted similar masses develop on various bones of her body The growth of all of the masses has been slow and painless

She was prompted to consult a doctor because of the large size of the mass on the inner aspect of the left thigh just above the knee which had begun to interfere with function



Fig 28 Case 7 A large mass springing from the posterior iliac crest and bilateral coxa vara. There was evidence of retardation of tubulation of the femora

Fig 29 Case 7 Note the large masses springing from both femora, and the wide metaphysis at the upper end of the fibulae, with spur-like masses on the inner aspect of both tibiae.

Physical Examination — Examination made on Nov 3, 1931, revealed the patient to be fairly well developed, about five feet tall. There was nothing unusual about the face and certainly no loss of symmetry. The shoulders were apparently symmetrical and the contour was not altered. There was a fullness in the infraclavicular spaces on both sides. The breasts were symmetrical. There was nothing unusual in the appearance of the chest or abdomen. Looking at the back we noted an irregular nodular appearance about the spine of the right scapula.

The lower extremities were asymmetrical in that the left thigh was less well developed than the right. There was a large prominent conical mass on the inner aspect of the left thigh just above the knee. The skin covering this was not altered in color. There was a prominent mass on the inner aspect of the left ankle.

On palpation over the right scapula, in the region of the spine particularly we found a nodular mass which seemed to spring from the region of the body of the spine of the scapula and the vertebral border.

There were nodular masses on the upper

outer portions of both humeri. The coracoid process seemed unduly large and nodular. The left forearm was shorter than the right. There was a nodular, prominent, hard mass on the dorsal and volar aspects of the radius at the lower end.

Under the outer upper quadrant of the left breast there was a hard, nodular mass which seemed to spring from about the third or fourth or the fourth or fifth rib.

Below the anterior crest of the ilium on both sides there was a hard, nodular mass which was not adherent to the skin and which was not tender. On the inner aspect of the right femur about the level of the abductor tubercle, there was a hard, sessile mass from approximately 2 5 inches to 3 inches in the transverse axis and 2 inches in the long axis of the body. This sessile growth seemed to spring from the lower metaphysis of the femur. The mass on the inner aspect of the left leg seemed to spring from the lower metaphysis of the tibia. There was a small mass on the inner aspect of the right tibia.

On the dorsum of the hand, over the metacarpals and phalanges, there were small, nodular, sessile masses.



Fig 30 Case 7. There was marked widening of the lower metaphyses and tibiae, with spur-like formations, there was also deformity in the metatarsals.

None of the masses described was adherent to the skin, nor was any one of them movable. No pain was associated with any of these masses, and, with the exception of the one on the inner aspect of the left femur, none was so located as to disturb the patient a very great deal.

The diagnosis was dyschondroplasia (Figs 31-39).

X-ray films were made of the entire skeleton. The films of the chest show involvement of ribs, both scapulae and both humeri. Below the glenoid fossa and near the angle of the scapulae, there were distinct irregular elevated lesions. The head of the right humerus was larger than the left. The upper three inches of the diaphysis of the right humerus was broader than the left. There was, apparently, an attempt at proper

tubulation of the upper portion of the shaft of the right humerus, as evidenced by a line suggesting a portion of the normal cortex, but this was covered by a large, less dense area of bone. If one had not seen other evidences of disturbance, he would have been inclined to think that a fracture had occurred in this region at some time in the past. The upper portion of the left humerus showed a marked vacuolization and there was a fusiform enlargement of the upper portion of the middle third of the shaft. There was no evidence of disturbance at the lower end of either humerus.

There were a number of exostoses on the ribs, particularly on the left side there was a large pedunculated mass which was much less dense than the surrounding bone. This sprang from the fourth rib. On the le-

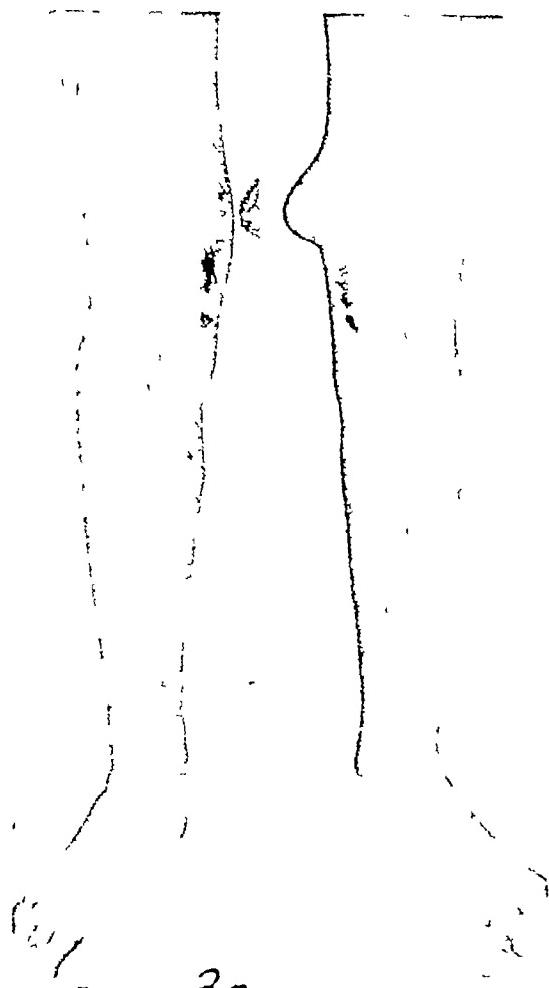


Fig. 31 Case 8 Dyschondroplasia. Physical examination showed a large mass on the inner aspect of the left femur and one on the inner aspect of the left ankle.

there was a smaller mass springing from the fifth rib

When comparing the films of the two hands and forearms, one noticed that the right hand was much larger than the left. All of the metacarpal bones and phalanges were larger on the right than on the left. There were exostoses on the phalanges, as well as the metacarpals on the right hand. The right radius was about 0.75 inch longer than the left and there were spur-like projections which sprang from the lateral aspect of both radii and ulnae. There was

bowing of both radii and ulnae on the right side. The lower end of the left radius showed a wide metaphysis and a small spur-like projection on the ulnar aspect, as well as a spur-like projection about the middle third of the shaft on the outer side of the radius. The ulna was shorter than the radius by about 0.5 inch. There was a wide metaphysis and a deformed lower end. The lower epiphysis was fused to the metaphysis in an oblique direction.

Examination of the films of the pelvis showed sessile growths springing from the crest of the ilium on both sides, and broad, flat, pubic arches which looked as though the patient barely escaped the additional defect of exstrophy of the bladder. There was a bilateral coxa vara. The neck of the femur, particularly on the left side, was extremely broad, in fact, it was almost as broad as the distance between the tips of the greater and lesser trochanters.

There was a very wide metaphysis of the lower end of the right femur with a horny projection at the lower end of the diaphysis. There was a wide metaphysis at the upper end of the tibia and a spur-like projection on the mesial aspect. The metaphysis of the upper end of the fibula, the head was distorted and there was, apparently, a large sessile growth between the tibia and fibula.

On the left side, the lower metaphysis of the femur was wide, on the mesial aspect of this metaphysis there were two pedunculated growths or exostoses. The density of one of these was irregular and vacuolated. The metaphyses for the upper end of the tibia and fibula were likewise very wide.

Examination of both knees showed wide fusiform lower metaphyses of the fibulae. The metaphysis for the lower end of the tibia did not seem to be as wide as that of the fibula.

Operation was suggested for the removal of the large mass in the inner aspect of the left femur and the one springing from the fourth rib on the left side. The patient was

advised to have others removed at a later date

Operation—Operation was performed on Nov 4, 1931. An incision was made over the large mass on the inner aspect of the femur. The muscles were found to be very thin at the apex of the mass. The muscle tissue was retracted from the tumor and its base was separated from the metaphysis by a sharp Campbell gouge. The rough edges were removed with a rongeur. Bone wax was used to control bleeding. The muscles were approximated and the skin closed.

At the same operation, we removed a small growth from beneath the left breast, which we found originated from the fourth rib. The pedicle was separated from the rib with a Campbell gouge. After bleeding was controlled, the tissue planes were approximated and the skin closed with interrupted dermal suture material.

The patient made an uneventful recovery from this operation.

This case provides additional evidence for the belief that the retardation phenomena which are responsible for the complete and partial retardation of tubulation must have occurred either in the developmental period or have been the result of a disturbance of the germ plasm.

CONCLUSIONS

1 Skeletal deformities and defects are due to retarded development at a particular period.

2 Fanciful theories making amniotic bands responsible for deformities should be discarded.

3 Congenital deformities are in many cases recessive and not dominant.

4 The theory of primogeniture is no longer tenable.

5 Clinical observations in cases of a three-phalanged thumb indicate that the

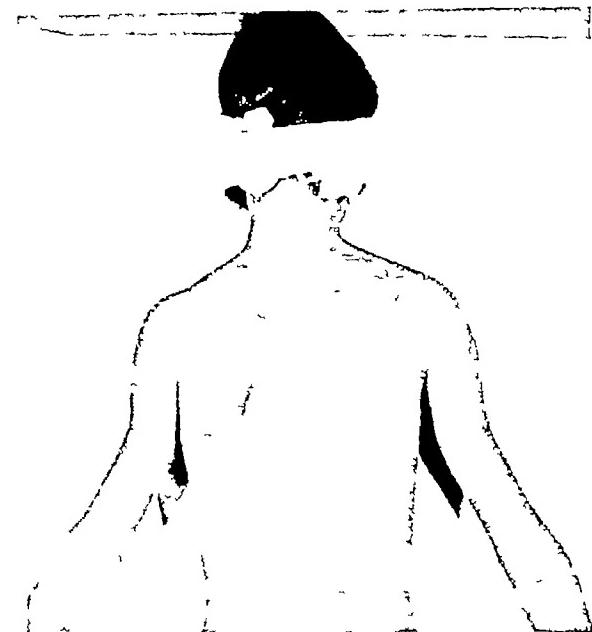


Fig. 32 Case 8 There was involvement of both scapulae and humeri



Fig. 33 Case 8 Involvement of the ribs, scapula, and humerus

metacarpal had disappeared in the process of evolution. What is ordinarily considered the first metacarpal is in all probability a first phalanx. This view is strengthened by the fact that the epiphysis of the so-called first metacarpal is at the proximal end—the position occupied by the epiphysis of the

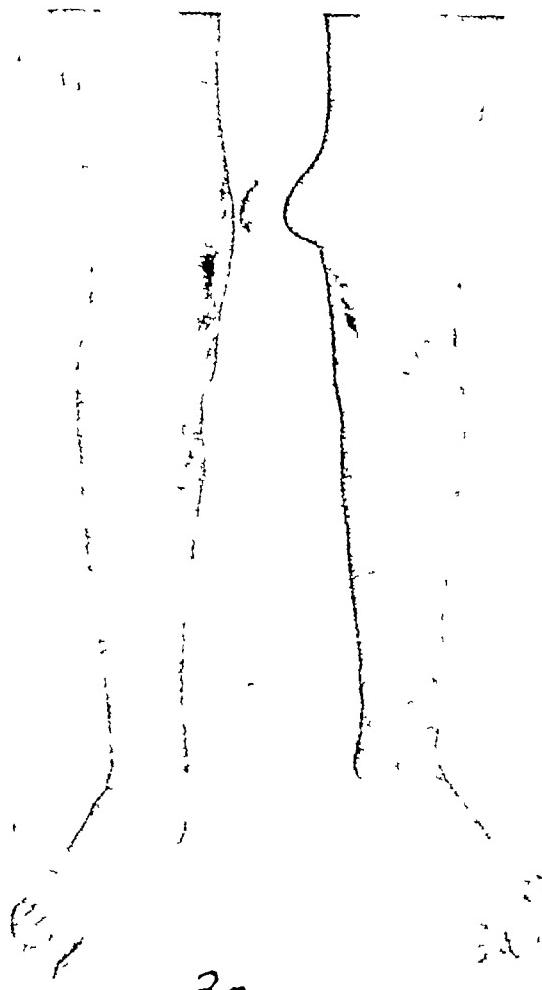


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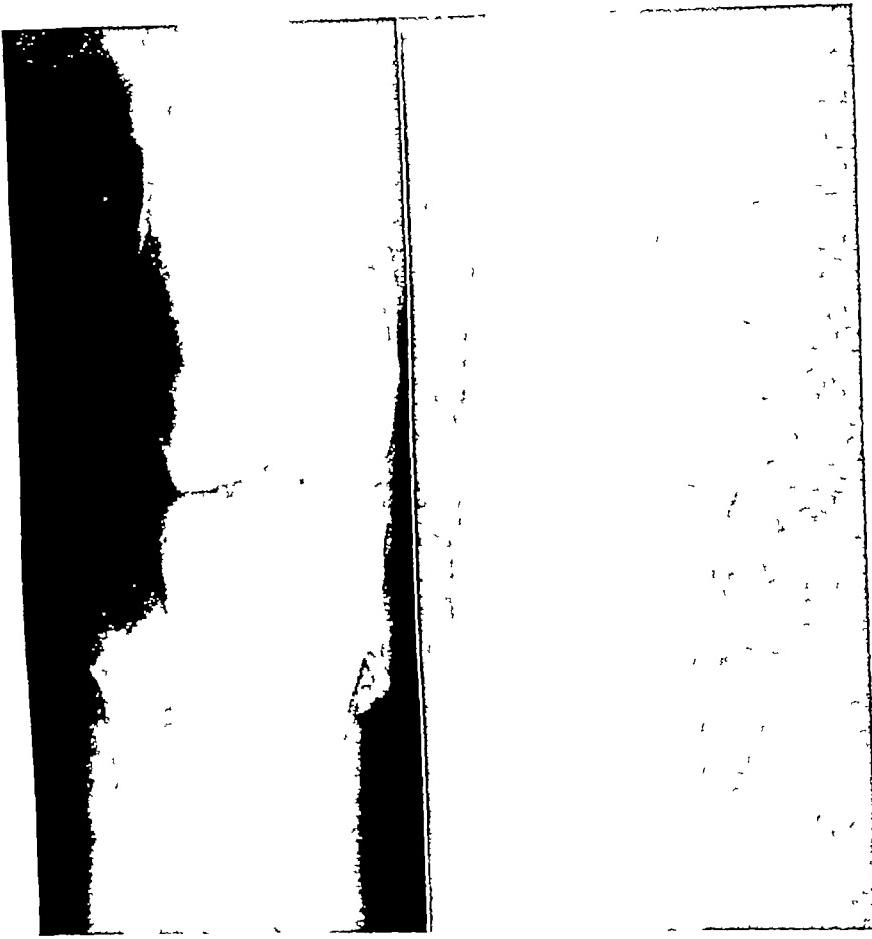
arrest of development of one or more of the processes necessary for bone growth and development

13 Retardation of tubulation results in wide metaphyses

pedunculated or sessile masses which interfere with function

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Figs 37 and 38 Case 8 Right and left knees, respectively

14 Partial retardation of tubulation results in exostoses

15 Exostoses are not essential to dyschondroplasia, but incidental

16 Dyschondroplasia may be limited to a single bone, or it may involve all bones except the skull

17 Jansen's theory of dissociation explains all of the phenomena which are found in dyschondroplasia

18 Operation is indicated only in the

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other phalanges—whereas the epiphysis of the other metacarpals is at the distal end

6 There is no reason to attempt to

8 Polydactylysm is of more than passing interest to the surgeon, particularly if there is a double thumb or great toe. In the

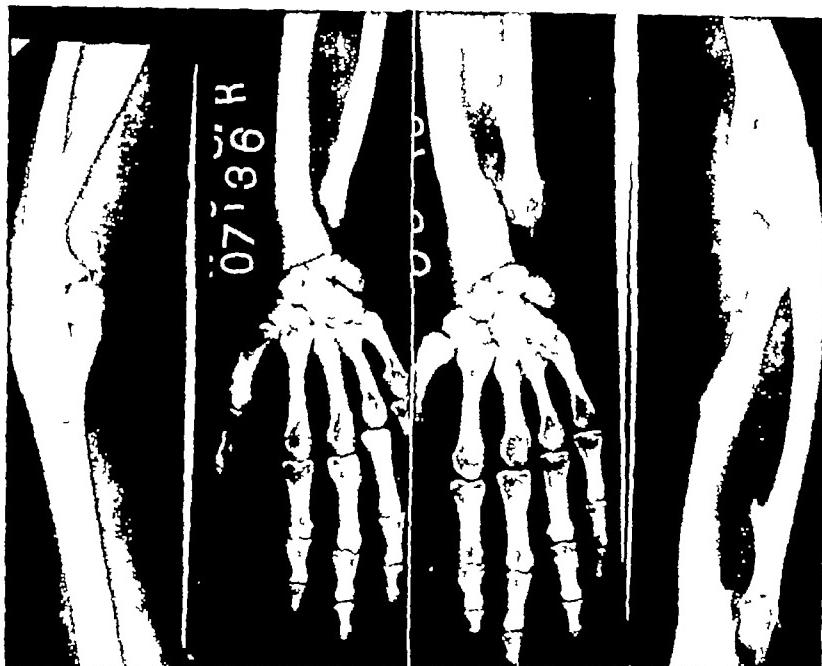


Fig. 34 (left) Case 8 Right upper extremity
Fig. 35 (right) Case 8 Left upper extremity

classify hereditary defects, as they can be legion

7 A single operation for the relief of syndactylysm, when complete, should not be attempted

case of the thumb it is most important to differentiate because of the musculature by which opposition of the thumb is accomplished

9 Hypodactylysm, syndactylysm, absence of carpal bones, and the absence of the shaft of the fibula in a single case bear testimony to the truth of the oft repeated statement that many defects are usually present in the same patient. Such cases indicate that there must be a developmental arrest responsible for the disturbance

10 The clinical cases reported in the first group include syndactylysm, polydactylysm, hypodactylysm, fusion of carpal bones, absence of carpal bones, defect of the fibula, ectromelia, and a three-phalanged thumb

11 Dyschondroplasia and other congenital deformities are identical in origin

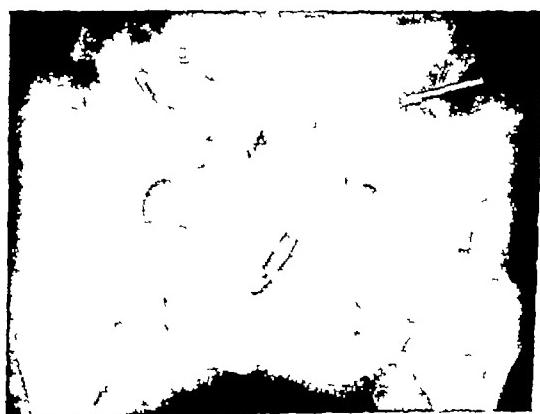


Fig. 36 Case 8 The pelvis showed growths on the iliac wings and broad nests

NOTE ON INTERNATIONAL COMPARISON OF X-RAY STANDARDS

By LAURISTON S TAYLOR, Bureau of Standards, WASHINGTON, D C

A RECENT paper¹ gave a description of comparisons of the Bureau of Standards X-ray ionization standard with that of the National Physical Laboratory, Physikalisch-technische Reichsanstalt, and Le Service d'Etalonnage de l'Hôpital St Antoine. In these comparisons it was necessary in all cases to make corrections for the absorption of X-rays in air, for which absorption coefficients were obtained by extrapolation from available data. These coefficients are, as pointed out, uncertain. Unfortunately, corrections for this paper, suggested by Dr Kaye, were received after it was too late to insert them. He informs us that their recent determinations of the air absorption correction under the conditions used in the comparisons give values somewhat different from those used in the published paper. For 110 KV unfiltered radiation Dr Kaye finds a correction of 2.2 per cent as against 1.5 per cent used in the published paper. For 143 KV, 1.4 mm copper, his correction agreed with the published value. Applying the first correction raises the values of the NPL determination by approximately 0.7 per cent.

¹L. S. Taylor, Bureau of Standards, Jour. Research (R.P. 397), 1932, VIII, p. 24, RADIOLOGY, January 1932
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|---|-------|
| When Kaye's values are used, Column 11, Table III, of the published paper becomes— | |
| Average difference of intact systems | -1.0% |
| Corrected for compensator differences | +0.5% |
| _____ | _____ |
| Average difference when using the same diaphragms | -1.9% |
| Corrected for compensator differences | -0.4% |
| The resulting NPL values for the magnitude of the roentgen, as given in Table IX, Column 4, is— | |
| 1.005 when corrected for diaphragm differences | |
| 0.996 when using the same diaphragm on both chambers | |
| 1.001 when averaging all readings taken | |

We would also call attention to an error (*Bureau of Standards Journal of Research*, Table III, p 16, line 3, RADIOLOGY, p 106, line 19). The sentence should read "Runs No 1 and No 3 are straightforward comparisons, Run No 2 was made with the tube diaphragm increased in diameter from 12 to 30 millimeters."

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Fig 39 Case 8 The wide metaphysis at the lower end of the fibula

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a rumor that the plaintiff had caused a roentgenogram to be taken, that there was no opportunity to verify the rumor until after the verdict was received, that afterward the defendants ascertained that the plaintiff had gone to a roentgenologist, who took a roentgenogram of her spinal column and ribs which showed that there had never been any injury to the spine and ribs, and that the roentgenologist informed her that she had not sustained any injury to her spine or ribs. The defendants contended that a new trial should have been granted because (1) the plaintiff was guilty of misconduct in suppressing and concealing the roentgenogram, and because (2) the roentgenoscopy constituted newly discovered evidence which the defendants could not with reasonable diligence have discovered and produced at the trial. But the evidence about the rib and spine affected the amount of the verdict rather than the right to a verdict. The roentgenoscopy was not made until six months after the date of the injury. The roentgenogram was not made a part of the record or exhibited to the trial judge. There was no affidavit by the roentgenologist, notwithstanding the fact that the plaintiff testified as a witness in her own behalf, and by doing so consented that the physician might testify as a witness. While the court does not intend to decide whether the trial judge could have compelled the plaintiff to submit to an examination on the application of the defendants, yet the court may with propriety note the fact that the plaintiff was not requested to permit physicians chosen by the defendants to examine her condition, and, so far as the question of her injury was concerned the defendants were apparently willing to rest their whole case on the testimony of one physician and of one of the nurses at the hospital. The plaintiff was a witness in her own behalf, and she was cross-examined. The defendants had ample opportunity to inquire as to whether or not any other physician had examined her and

whether a roentgenogram had been taken, and yet no such inquiries were made. In view of the fact that the defendants did not take full advantage of the opportunities offered by cross-examination, and in view of the other facts shown by the record, the court does not think it would be justified in reversing the trial court and holding that he should have allowed a new trial on the ground of newly discovered evidence. Nor does the court think that it could fairly be said that the plaintiff was guilty of suppressing evidence. She knew whether she suffered any pain, and she also knew where the seat of the pain was. So overwhelming was the evidence that it might be said to have conclusively established that she suffered pain in the side. The physician who examined her on the evening of the accident stated that he did not discover any broken rib or twisted spine. The physician who called on her five days afterward and from that time on acted as her attending physician testified that her rib was broken and that her spine was twisted. The roentgenogram was not taken until six months after the accident, and, for aught that appeared in the record, the broken rib, if there was one, might have completely united, leaving no evidence of a former break. The court was not advised as to whether medical men would say that a break either sometimes or always leaves evidence of the break which a roentgenogram will invariably picture, nor does it know how serious the break must be in order to leave permanent evidence of the fracture. If the plaintiff's rib was broken, it might be that it was a slight break, and no evidence of the fracture remained when the roentgenogram was taken. The plaintiff was not bound to believe the opinion of the physician who took the roentgenogram six months after the accident, but, knowing that she actually suffered pain, and having been told by her attending physician that her rib was in truth broken, she had a right to believe as she undoubtedly did that her rib

HOW WE MAY REDUCE THE NUMBER OF MALPRACTICE SUITS

By I S TROSTLER, MD, FACR, FACP, CHICAGO

If we can materially reduce the number of malpractice suits filed, we will, as a matter of course, reduce the number to be contested in the courts and the number of verdicts with judgments to be paid, and so, in an indirect and roundabout manner, reduce the premium rates of our malpractice insurance.

From even a casual observation, it is quite clearly evident that malpractice suits are greatly increasing in number and frequency. While the direct cause of this is not clearly patent, much of the increase is correctly attributed to what may well be called malicious tongue wagging. Any one who comes much in contact or has any considerable experience with malpractice suits, knows that too freely discussing the merits and demerits of fellow-practitioners and competitors, with or in the hearing of patients, tends markedly toward the instigation of malpractice suits. In no other profession is this practice so prevalent as it is among physicians. It is practically unheard-of in the various irregular healing cults, but it seems to be on the increase in the regular medical profession. This condition can and should be remedied by organized medicine, by prompt and radical action against these tongue-wagging and innuendo-uttering physicians. If a few suits for slander were filed against the men who instigate the malpractice suits, it would cause some of them to think a second time before making disparaging remarks about their confreres or competitors. Such action would go far toward curbing the malicious gossip of many who are far too ready to say and do things that tend to disparage the actions and practices of their fellow-practitioners. Let us make an example of the physicians who maliciously talk about other physicians' ability, practices,

or conduct of their practice. Make them prove what they allege or pay for their libel. Let us broadcast that we are going to do that and warn them of what we propose to do.

Another important consideration in the prevention of adverse decisions and verdicts against physicians is that practically no malpractice suits can be won without expert testimony that the acts complained of are irregular, wrongful, and constitute conditions recognizable as malpractice. If it were impossible to secure this expert medical testimony, not many malpractice suits could be or would be successful and the legal profession would not be so ready to take the cases and so frequently able to prosecute them to a successful termination.

Here is another potent and powerful means of reducing the number of suits filed and verdicts rendered against our brethren. Let us make it unpopular for any physician to instigate suits or to lend aid by furnishing expert testimony in prosecution of these suits, in that way lessening their frequency and consequently reducing our insurance premiums. *Operæ pretium est.*

REPORTS OF CASES OF INTEREST TO RADIOLOGISTS

DISCOVERIES AS TO ROENTGENOGRAM NOT GROUND FOR NEW TRIAL

(Caldwell *vs* Hoskins *et al* (Ore.),
186 Pac R. 50)

The Supreme Court of Oregon, in affirming a judgment in favor of the plaintiff for damages for personal injuries, says that the defendants filed a motion for a new trial based on affidavits to the effect that a few minutes before the jury returned the verdict the attorneys for the defendants learned of

verdict was for \$2,500. The defendant claimed that it was excessive. The trial occurred a year after the injury. After the injury developed the plaintiff wandered from doctor to doctor for several months. Finally she went to the hospital. She was there six months. The pain had been considerable. At the time of the trial, so her claim was, she was unable to work. The sore was still open and of considerable extent. One physician said it was uncertain whether it would be permanent. The verdict was not excessive.

STANDARDS FOR TREATMENT WITH
ROENTGEN RAYS

(*Hunter vs Burroughs (Va.)*, 96
S E R 360)

The Supreme Court of Appeals of Virginia, in a lengthy opinion, affirms a judgment in favor of plaintiff Burroughs for damages alleged to have been occasioned to him by the alleged malpractice of the defendant, a physician, in the treatment with roentgen rays of eczema with which the legs and ankles of the plaintiff were affected. The Court says that it should be borne in mind that the case involved two standards of professional skill and care by which the evidence as to the competency and the conduct of the defendant was to be measured, one standard having reference to the technic or mechanical operation of the roentgen-ray apparatus, and the other standard having reference to the possession and use of the professional skill and care incumbent on the defendant with respect to the diagnosis and treatment of the disease of the plaintiff in matters other than the mere mechanical operation of the apparatus.

The two standards mentioned both involved in this case, the highly specialized art of the treatment of the disease of the plaintiff by roentgen rays, and so far as they did so expert testimony before the jury

fixing such standards was essential to the support of the verdict of the jury, since otherwise the jury, to the extent of the questions involving such specialized art, would have had no standard in mind by which to measure the other facts proved in the case. Now, as to the mechanical standard of skill and care, there was no expert evidence in the case except the testimony of the defendant and of other expert witnesses for the defendant, but there was sufficient evidence in the case, when measured by the mechanical standard fixed by the testimony of the defendant, to support the verdict of the jury. It is deemed sufficient to mention only the following details of such evidence. There was evidence in the case to the effect that the defendant did not keep an accurate record of the roentgen-ray treatment or any record of the exact "dose" of roentgen rays applied in the several treatments therewith, that if only the standard "dose" had been applied, it was extremely improbable that any bad result would have been caused. The cross-examination of the defendant tended to show that his memory of the "dose" applied by him in the several treatments was not to be relied on. There were inconsistent statements made by the defendant at different times as to his opinion of the causes of the bad result, and there was other evidence to support a conclusion of the jury that the "dose" in fact applied was not in accordance with the mechanical standard fixed by the expert testimony of the defendant himself. It was true that such testimony did not show that the bad result might not have happened without fault of the defendant, but there was sufficient of such evidence, the credibility and weight of which was for the jury, tending to show that the bad result was more probably due to lack of skill or negligence of the defendant as charged. This degree of proof is all that is required of a plaintiff in a civil case. He is not required to exclude by his proof the possibility of the result complained of hav-

was broken, and she was under no obligation to call the roentgenologist as a witness merely because his opinion, based on an examination made six months after the injury, differed from the opinion of her attending physician

A CELEBRATED CASE LIABILITY FOR ROENTGENOGRAPHIC BURN—"RES IPSA LOQUITUR"—CARE REQUIRED

(*Holt vs Ten Broeck (Minn.)*, 159 N W R 1073)

The Supreme Court of Minnesota affirms a judgment for \$2,500 damages in favor of the plaintiff for injury from a burn alleged to have been caused by the negligence of the defendant in taking a roentgenogram. The court says that, in February, 1915, the plaintiff was under treatment for some trouble in her hip supposed to be a fracture or a dislocation. Her attending physician desired a roentgenogram. The defendant, a regularly licensed physician, took it. A few weeks afterward a sore developed on the plaintiff's hip which it was claimed was the result of a roentgenographic burn. The evidence was sufficient to sustain a finding that the roentgen ray caused the sore. The testimony of the plaintiff was that there was none before. It was at the point of the exposure. There was medical testimony having a tendency to prove that it came from a roentgenographic burn. The question was for the jury. To recover damages it was necessary that the plaintiff prove negligence in the defendant. There was little direct evidence of negligence. The plaintiff claimed that during the progress of the taking the defendant made some exclamation to the effect that the machine was not working right. Her claim was that the exposure was unduly long, but her testimony did not strongly support it. A physician sufficiently qualified to give an opinion as an expert stated that a proper application of the rays would not produce the result which he found. The

evidence was that with a proper machine and with a proper use of it a burn is unusual. There was evidence that the machine was a proper one. The machine and its operation were wholly under the control of the defendant. Under such circumstances the rule of *res ipsa loquitur* (the matter speaks for itself) applies. It did not follow from this, as the plaintiff's counsel argued, that the burden shifted to the defendant of proving freedom from negligence. "*Res ipsa loquitur*, where it applies, does not convert the defendant's general issue into an affirmative defense." The language quoted was approved in a case in which this court held that the *res ipsa loquitur* rule merely permits the jury to draw an inference of negligence, and "the jury is to consider and weigh the inference, in the light of all the facts and circumstances, and give it such weight as tending to prove negligence as they deem it entitled to." It does not follow from what is here said that the *res ipsa loquitur* doctrine applies to a bad result or mishap coming from a physician's treatment. The rule does not apply in such cases. In determining negligence it can make no difference whether the one operating the roentgenographic appliance is a physician or a lay expert. The care required is ordinary care. It is the care exercised by and to be expected from one reasonably skilled in the use of the appliance. The rays were not applied for curative purposes, but to obtain information. This is the logical if not the necessary result of the holding in *Henslin vs Wheaton*, 91 Minn. 219, 97 N W R 882, that in an action against a physician for negligence in the use of a roentgenographic machine he was not entitled to have the question of his skill determined by physicians of his own school. A physician who qualified himself as an expert in the application of the roentgen ray was permitted to give his opinion, based on the result of the operation, that the application was improper. This was not error. The

satisfaction of the demand, will legally satisfy it, however large the claim may be A debt or demand is liquidated when agreed on by the parties or fixed as to the amount by the operation of law The account in this case was made up of charges for visits made by the plaintiff, as a physician in attendance on the defendant and his family, from Nov 4, 1911, to May 30, 1915, and totaled \$1,347, on which payments were credited, of \$200 in 1912, \$200 in 1913, \$300 in 1914, and \$200 in 1915 It was admitted at the trial that it was not necessary for the plaintiff to prove each of his items in detail, but that it would be conceded that he would testify to the correctness of each item The defendant contended, however, that the last payment was made by him and accepted by the plaintiff as in full of all amounts due the plaintiff In no sense could this be said to have been a liquidated account While it was true that the defendant did not dispute that the services had been rendered and that the charges made for them were reasonable, he nowhere admitted that he owed them On the contrary, when his attention was called to the account rendered just before he sent his check for the last payment, he called the plaintiff's attention to the fact that they had before settled on a compromise basis and proposed to do that here, and on the plaintiff's stating that his account was about \$400, the defendant stated that he would pay \$200 if the plaintiff would accept that in full It was true that the plaintiff denied this conversation over the telephone but that was for the jury, the defendant having distinctly testified to it It was under these circumstances that the defendant made out his check for \$200, writing on it that it was in full, transmitted it by letter calling attention to that sum and the plaintiff accepted the check and cashed it Under these circumstances the plaintiff was bound by his act and could not claim anything over and above the \$200 His recep-

tion and retention of the \$200 in full payment of his account, that not being a liquidated account, or an account stated, was conclusive on him

DOCTRINE THAT AN ORDINARY PHOTOGRAPH
IS THE BEST EVIDENCE OF WHAT IT
CONTAINS DOES NOT APPLY TO RA-
DIOGRAPHS EXPERT OPINION
THE ONLY EVIDENCE TO
BE CONSIDERED¹

Marion vs Coon Construction Co (New York), 1913, Third Department, Vol 157, App Div 95

This was an action to recover damages for personal injuries sustained by the plaintiff, who was struck by a boom while signaling the engineer controlling the operation of the derrick The jury found a verdict for the plaintiff and the defendant appealed from a judgment entered on that verdict The judgment was affirmed

One of the errors alleged by the defendant on the appeal related to the failure of the plaintiff to produce X-ray pictures concerning which expert witnesses for the plaintiff testified On this point the Court said at page 99.

A careful reading of all the medical evidence and the other evidence as to injuries will show that the plaintiff was substantially injured One of the plaintiff's witnesses, Dr Gardner, swears "I was present when the (X-ray) pictures were taken, saw them taken, saw them developed, and looked at the plates immediately after they were developed" Thus their identity and correctness were established Then the Doctor proceeds to tell what the pictures show Another physician, Dr Tinker, also tells what he thinks the plates show There was no demand made by the defendant for the production of the plates, no hint or suggestion that they were desired They were, in fact, in court, so the plaintiff states in his brief I can see no error at all in this X-ray incident *The evidence*

¹Received from Leon T LeWald M D New York City

ing been due to causes for which the defendant is not responsible

The cause of the injury being the roentgen rays was, however, but one element of fact in the case. As the jury was properly instructed, if the defendant exercised ordinary care and skill in the premises, the plaintiff was not entitled to recover damages, although the injuries complained of were caused by the roentgen-ray treatment, and the question still remained whether the defendant did or did not exercise such care and skill. The Court thinks there was sufficient evidence in the case, when measured by the general professional standard, as well as by the mechanical standard of skill and care, to support the verdict of the jury.

It was correct to say that the standard by which the duty of the defendant to make the preliminary tests and examination of the patient before subjecting him to the roentgen-ray treatment had to be tested was whether other like specialists in good standing, in the same or similar localities as the defendant, would have been guilty of the omission to make such preliminary tests and examination, which test had to be applied by measuring the evidence, as it might be introduced on the trial, by the standard fixed by the testimony of experts on the subject. Failure to warn of danger in the treatment was not necessarily negligence, unless there was an assurance of a cure.

AN IMPORTANT DECISION PHYSICIANS NOT REQUIRED TO REPORT TO DEFENDANTS

(Tutone *vs* New York Consolidated R Co (N Y), 177 N Y Supp 818, Herbert *vs* Brooklyn Heights R Co, (N Y) 177 N Y Supp 901)

The Kings County, N Y, court holds in these two personal injury cases that orders for the physical examination of the plaintiffs by physicians were erroneous in requiring that the reports of the physicians should be given to counsel for the defendants. The decisions are by two different

justices. In the Herbert case, Justice May says there is nothing in the New York statutes which directs or requires a report to be made by the examining physician. The sole object of the statute in permitting physical examinations is to reduce the likelihood of fraud being practised to a minimum, by granting the right to the defendant to compel the plaintiff merely to submit to such physical examination at the hands of the physicians, so that testimony thereof may be given on the trial. While it has been customary for physicians so appointed to make a report and deliver it to the defendant, there is no authority apparently in the law therefor. There may be no objection, perhaps, to the disclosure by the physician to the defendant of the results of his examination, but the court has no power to direct him to make such report, and therefore it follows that there can be no direction to deliver a report to the defendant, or to file a report in the office of the county clerk.

EFFECT OF RECEIVING CHECK "IN FULL OF ACCOUNT"

(Booth *vs* Dougan (Mo), 217 S W R 326)

The St Louis (Mo) Court of Appeals affirms a judgment in favor of the defendant, who was sued by a physician for a balance of \$447 claimed to be due on account after the physician had indorsed and collected through the bank a check for \$200 reading "In full of account to date," which the defendant had sent to him. The Court recognizes the rule to be that when a certain sum is due from one to another, the payment of a lesser sum is no discharge as to the remainder, notwithstanding an agreement to that effect, because the latter agreement is without consideration. But such rule, the Court says, does not apply when the amount due is disputed or unliquidated. When a claim is unliquidated, any sum, no matter how small, given and received in

CASE REPORTS AND NEW DEVICES

LYMPHOSARCOMA OF THE FEMUR

By E. A. POHLE, M.D., PH.D., and GORTON RITCHIE, M.D.
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H E R, male, aged 30 years, fractured the left femur just above the knee on March 2, 1931, while walking in the woods. The leg was put in traction for five weeks. He stayed in the hospital for another week and was then discharged. On May 14, 1931, he refractured his leg while in bed and returned to the same hospital, where Lane

He entered the University Hospital in Madison on the Orthopedic Service on Aug 8, 1931, with the probable diagnosis of non-union of fracture of left femur with secondary osteomyelitis.

The general physical examination revealed that the patient was considerably emaciated and anemic. There were tender swollen bony masses over the head of the right radius, over several ribs, and also on the right parietal bone. There was also a draining sinus in the mid-portion of an old surgical incision on the anterior aspect of the left lower thigh. The latter was considerably swollen and very tender. Motion



Fig 1 Roentgenogram of femur

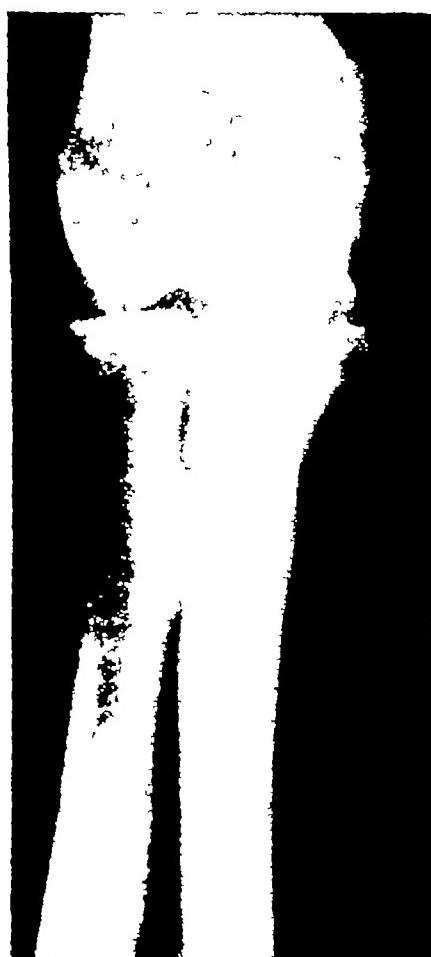


Fig 2 Roentgenogram of the right arm, showing lesion in radius

plates were inserted on May 20, 1931. One week later the wound started to drain and two drains were inserted on July 1, 1931.¹

¹We were unable to obtain roentgenograms taken before the patient came to us.

shows that nobody but an X-ray expert could tell anything from the plates, and that if they had been produced they would have done the court, jury, or the defendant's ordinary physicians no good I do not think that the doctrine that an ordinary photograph is the best evidence of what it contains should be applied to X-ray pictures They constitute an exception to the rule concerning ordinary documents and photographs, for the X-ray pictures are not, in fact, the best evidence to laymen of what they contain Generally, they are no evidence at all, signifying nothing whatever except to the expert The opinion of the expert is the best evidence of what they contain—the only evidence If there had been a demand for these pictures in court, or a request that they be submitted to the inspection of the opposing experts, and these rights had been denied the defendant, such an error would be serious But whatever harm befell the defendant, if there was any harm at all, came to it by reason of its own failure to demand what it was entitled to, and what it would unquestionably have received by the mere asking To sustain this contention of the defendant would be to tolerate worse than a technicality—a trick

PROPER TIME FOR ROENTGEN-RAY EVIDENCE

(Van Tinder *vs* Birmingham Railway,
Light & Power Co (Ala),
80 So R 858)

The Supreme Court of Alabama, in affirming a judgment in favor of the defen-

dant in this personal injury case, says that the plaintiff urged that a new trial should be granted because of newly discovered evidence resulting from a roentgen-ray examination of her back showing the nature and character of her injury and its probable cause But the Court does not think that this was a good ground for granting a new trial, for one reason, because it is not persuaded that due diligence was shown in obtaining this roentgen-ray examination The plaintiff relied, among other things on permanent injuries to her spine, and it was but fair to herself, the defendant, and the court that she should have obtained and produced the best evidence on the subject, and the reasons for resorting to a roentgen-ray examination were as important before as after the trial It is a matter of common knowledge that in cities the use of the roentgen ray for the discovery and diagnosis of internal injuries and abnormal conditions of the human body is of common occurrence True, it may incur some trouble and extra expense but the trouble and expense should be no greater before than after the trial, and the reasons and necessities for them should be as imperative for the original trial as for upsetting or overturning the verdict of a jury after it has passed on the issue to which the examination relates and which was contested on the trial

examined It was gray-white, somewhat vascular, and soft Small areas of hemorrhage were noted, but nowhere was there extensive necrosis

Unfortunately permission was not obtained for examination of the brain.

Microscopically, the tumor proved to be a lymphosarcoma (Figs 3 and 4), with many types of cell, apparently all of the lymphoid series It was felt that the primary site of the growth was in the left femur

AN IMPROVED METHOD FOR THE ORAL ADMINISTRATION OF SODIUM TETRAIODOPHENOL-PHTHALEIN FOR GALL-BLADDER VISUALIZATION

By LESTER LEVYN, M.D., and
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The oral administration of sodium tetraiodophenolphthalein is the method of choice among the great majority of roentgenologists Menees and Robinson (1) were the first workers whose experiments, reported in 1925, resulted in the widespread use of the dye by mouth The powdered dye was given in various types of enteric tablets and capsules, to withstand the attack of the gastric juices In 1927, we published a method of administering the dye in solution (2) Since then, numerous soluble preparations have been available, and the use of the disodium salt in powder form, in tablets, or capsules, is almost obsolete

Some of the preparations used are objectionable to patients because they are distressingly unpleasant to take, and reactions vary in degree from slight nausea to severe attacks of vomiting Even in the more pleasant preparations, patients complain of

the drinking of 200 cc or more of an astringent, acrid-tasting solution

A standardized method of oral administration of the dye is obviously most desirable With these facts in mind, we have evolved a method which has proved most satisfactory in our hands

PREPARATION OF A SINGLE DOSE

Four grams of sodium tetraiodophenolphthalein are placed in a mortar, and 0.30 cc of hydroxysuccinic acid ($\text{COO H CH}_2 \text{CH}(\text{OH}) \text{COO H}$ —malic acid) is added The hydroxysuccinic acid prevents decomposition of the dye by breaking up the unstable disodium salt into the stable monosodium salt and sodium malate Liquid petrolatum levis, in the amount of 3 cc, is next added and the mixture thoroughly triturated Two *elastic* gelatin capsules, such as various oils are dispensed in, of a capacity of 2.5 cc each, are then filled with this mixture by means of a pipette, and the aperture sealed with heat¹

The advantages of the use of these *elastic* capsules, prepared in this manner, are as follows

- 1 The capsules are absolutely devoid of taste and are easily swallowed
- 2 Nausea and vomiting are reduced to a minimum
- 3 The dye is suspended in a finely divided state, and passes through the pylorus into the duodenum upon the disintegration of the capsules, which occurs (fluoroscopic observation) from one to two hours after they are taken In many instances the capsules leave the stomach intact and are disintegrated in the small bowel

4 This method makes available a standardized procedure

5 Excellent gall-bladder visualization is obtained in children and adults

¹Owing to the fact that the filling and sealing of these capsules by hand is tedious and time-consuming, one of the chemical houses has kindly consented to manufacture them

could be felt at the site of the fracture Roentgenographic examination (Fig 1) showed an old fracture of the left femur approximately 6 inches above the knee, held by two Lane plates, without union While

AUTOPSY REPORT

The external description was similar to that recorded in the physical examination The chief interest attached to the extent and distribution of the tumor growth The left

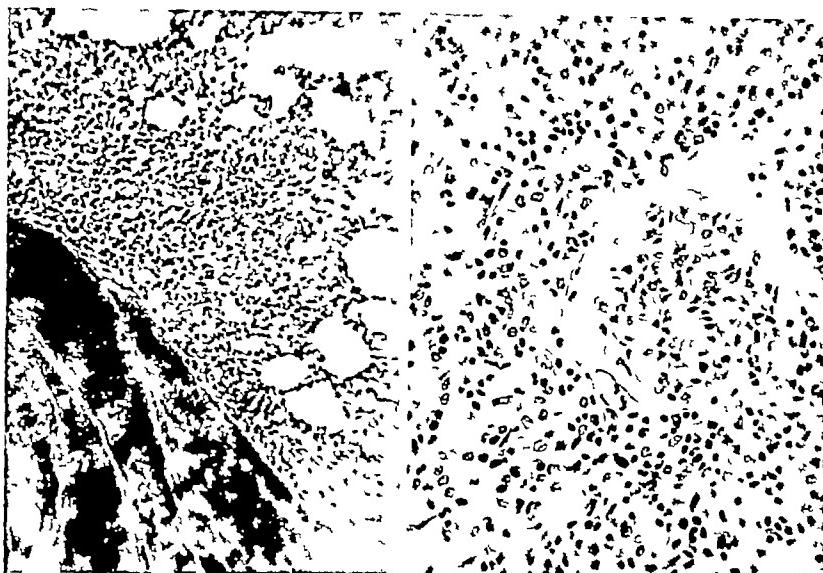


Fig 3 (*left*) Section of original tumor in left femur

Fig 4 (*right*) Tumor nodule in kidney, showing surviving glomerulus

the presence of productive bone changes suggested osteomyelitis there were also several areas of destruction which indicated in all probability a metastatic malignancy The latter impression was borne out by the fact that similar destructive lesions could be seen in the neck of the left femur, the right ilium, the right upper radius (Fig 2), right parietal bone and fifth and sixth right and eighth left ribs The only intimation as to the site of the primary lesion was found in the intravenous pyelogram, on account of which hypernephroma was suspected All laboratory examinations were essentially negative except for a marked anemia No Bence-Jones bodies were found in the urine The patient failed rapidly, developed signs of cerebral involvement on Aug 20, 1931, and died ten days later

femur was fractured at about its midpoint, and besides a considerable degree of callus formation there was extensive tumor growth in and about the bone The soft tissues were infiltrated and one nodule had appeared in the operative scar There was widespread metastasis, several ribs were involved, the growth here being fusiform in shape and having eroded the bone so completely as to cause spontaneous fractures There were flat neoplastic plaques in the subepicardial tissue Both suprarenal glands were infiltrated, and nodules were found in each kidney In the rectovesical septum there was a nodule about 4 cm in diameter No considerable lymph node enlargement was found anywhere in the body

The tumor substance presented essentially identical characteristics wherever it was

examined It was gray-white, somewhat vascular, and soft. Small areas of hemorrhage were noted, but nowhere was there extensive necrosis

Unfortunately permission was not obtained for examination of the brain

Microscopically, the tumor proved to be a lymphosarcoma (Figs 3 and 4), with many types of cell, apparently all of the lymphoid series It was felt that the primary site of the growth was in the left femur

AN IMPROVED METHOD FOR THE ORAL ADMINISTRATION OF SODIUM TETRAIODOPHENOL-PHTHALEIN FOR GALL-BLADDER VISUALIZATION

By LESTER LEVYN, M.D., and
A H AARON, M.D.,
BUFFALO, NEW YORK

The oral administration of sodium tetraiodophenolphthalein is the method of choice among the great majority of roentgenologists Menees and Robinson (1) were the first workers whose experiments, reported in 1925, resulted in the widespread use of the dye by mouth The powdered dye was given in various types of enteric tablets and capsules, to withstand the attack of the gastric juices In 1927, we published a method of administering the dye in solution (2) Since then, numerous soluble preparations have been available, and the use of the disodium salt in powder form, in tablets, or capsules, is almost obsolete

Some of the preparations used are objectionable to patients because they are distressingly unpleasant to take, and reactions vary in degree from slight nausea to severe attacks of vomiting Even in the more pleasant preparations, patients complain of

the drinking of 200 cc or more of an astringent, acrid-tasting solution

A standardized method of oral administration of the dye is obviously most desirable With these facts in mind, we have evolved a method which has proved most satisfactory in our hands

PREPARATION OF A SINGLE DOSE

Four grams of sodium tetraiodophenolphthalein are placed in a mortar, and 0.30 cc of hydroxysuccinic acid ($\text{COO H CH}_2 \text{CH}(\text{OH})\text{COO H}$ —malic acid) is added The hydroxysuccinic acid prevents decomposition of the dye by breaking up the unstable disodium salt into the stable monosodium salt and sodium malate Liquid petrolatum levigatum, in the amount of 3 cc, is next added and the mixture thoroughly triturated Two *elastic* gelatin capsules, such as various oils are dispensed in, of a capacity of 2.5 cc each, are then filled with this mixture by means of a pipette, and the aperture sealed with heat¹

The advantages of the use of these *elastic* capsules, prepared in this manner, are as follows

- 1 The capsules are absolutely devoid of taste and are easily swallowed
- 2 Nausea and vomiting are reduced to a minimum
- 3 The dye is suspended in a finely divided state, and passes through the pylorus into the duodenum upon the disintegration of the capsules, which occurs (fluoroscopic observation) from one to two hours after they are taken In many instances the capsules leave the stomach intact and are disintegrated in the small bowel

4 This method makes available a standardized procedure

5 Excellent gall-bladder visualization is obtained in children and adults

¹Owing to the fact that the filling and sealing of these capsules, by hand, is tedious and time consuming, one of the chemical houses has kindly consented to manufacture them

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CARCINOMA OF THE CERVIX WITH BONE METASTASIS

REPORT OF CASE

By RIEVA ROSH, M.D., Assistant Radiation Therapist From the Radiation Therapy Service, Bellevue Hospital, New York City, Ira I. Kaplan, M.D., Director

Bony metastases associated with malignancy of the breast, prostate, and thyroid gland are of frequent occurrence. While direct pelvic extension or local metastases

occur often, especially in neglected and untreated cases of carcinoma of the cervix, distant metastases from carcinoma of the cervix uteri, especially to bone, are very rare.

From the Mayo Clinic, Ford (1) reports 14 cases of bone metastases associated with carcinoma of the cervix, the tibia being involved in two cases. Albers-Schonberg reports 564 postmortem examinations of carcinoma of the cervix, 0.83 per cent of which showed metastases to long bones. Wertheimer reports 13 cases of metastases from carcinoma of the cervix, but only one case with involvement of both tibias. Jeananey (2) reports one case of metastasis to the tibia from primary squamous-cell epithelioma of the cervix, Grade 4. Monad (4) reports one case of metastasis to the sternum from a carcinoma of the cervix.

In our series of 233 cases we have had only one case showing metastasis to bone.



Fig 1 Photomicrogram showing lesion of the cervix.



Fig 2 Photomicrogram showing lesion of the tibia.

W E., widow, white, 58 years of age, entered the gynecologic service of Bellevue Hospital, July 11, 1927, complaining of vaginal bleeding which had been apparent for six months. She had had two children, normal deliveries. The menstrual history, which began at 15 years, was regular, with no pain, of eight days' duration, moderate flow. The menopause was at 43 years. The bowels were regular. Six months previous to admission the patient, having noticed a bloody discharge following a hot douche, went to a doctor, who sent her to the hospital.

Vaginal examination showed an atrophic introitus with foul bloody discharge. The cervix was situated in the axis of the vagina, and was hypertrophied, eroded, and large. The fundus was retroverted, not outlined, and appeared small. The adnexa were negative. The Wassermann reaction was negative. Biopsy of the lesion showed a plexiform epithelioma.

The patient was advised to have radiation therapy and was treated with deep X-radiation to the pelvis and radium to the uterus and cervix. She received 860 r units of high voltage X-rays to the right and left anterior and posterior pelvic areas and 5,300 mc-hrs of radon. Following treatment the cervix lesion healed completely.

Until Nov 22, 1929, the patient's general condition remained good, when she came to the clinic complaining of slight pain and swelling in the shaft of the left tibia. She gave a history of having had an injury to this leg several months previous to November, at which time the lump appeared and did not subside after applications of compresses. Gynecologic examination on Nov 22, 1929, revealed a completely healed cervix, there was no bleeding or evidence of local metastasis or recurrence. On the left tibia a small tumor mass was palpable, firmly attached to the shaft.

An X-ray film of the tibia showed a large polycystic destructive area in the mid-third



Fig 3 Roentgenogram of the lesion in the tibia

of the left tibia, 6 cm in length, occupying the full width of the shaft with some irregularity of the cortex anteriorly. In the opinion of the roentgenologist, the findings did not suggest a malignant lesion but probably an osteitis fibrosa cystica or a giant-cell tumor.

On account of the pain and the presence of tumor growth deep X-ray therapy was given to the leg. On Feb 20, 1930, the swelling appeared larger. X-ray examination revealed at this time a polycystic neoplastic mass in the mid-third of the tibia which simulated the structure of a giant-cell tumor, more so than on the previous examination. On May 20, 1930, her general condition was good, but the patient complained of pain in the left leg. Radiographic examination showed a tumor mass present in the middle of the shaft of the left tibia, with evidence of widening of the shaft at this region, cystic formation in the medulla and cortex of the bone, with trabeculation characteristic of osteitis fibrosa cystica. A node, 1 cm in diameter, was found in the left inguinal

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Fig 1 Photomicrogram showing lesion of the cervix.



Fig 2 Photomicrogram showing lesion of the tibia.

ing built around a small copper filter pan in which the radium was later placed. It was molded to extend backwards far enough to curve up in the pharynx around the soft palate, and this curved part was split to accommodate the posterior part of the nasal septum, and the curved ends perforated with hot wire to make holes for cords, as shown in the illustration. The radium was loaded in the pan filter, covered with a rubber filter, and applied to the lesion by passing threaded catheters through each nostril, the threads being drawn forward through the mouth and attached to each of the cords of the radium pack. Application was made by pulling the cords forward through the nares until the pack was fitted snugly in place. The pack was slipped over the fingers of the operator while the cords were being drawn taut by an assistant. When the cords were taut, it was seen that the appliance hugged well the posterior extremity of the soft palate, and, as they were tightened, they drew upward the posterior surface of the palate, bringing the affected tissues in direct contact with the radium pack. It was an easy mat-

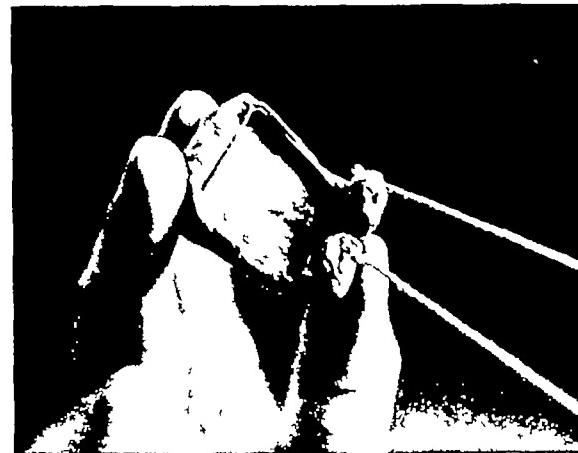


Fig 1 Radium pack for application to the under surface of the posterior part of the soft palate

ter to leave this pack in place until the desired dosage in milligram-hours was delivered. The cords were tied behind the patient's head, and, while this may be an objection to the pack, there is no possible chance for it to slip or for the patient to move it after it is in place.

Since the patient made no complaint of the presence of the pack, we feel that this appliance is not uncomfortable to wear.

area. Surgical removal of the mass was advised, to be followed by radium application.

The patient entered the hospital on June 2, 1930, and on June 6 the mass in the left tibia was excised. The pathologic findings were an extensive invasion of the bony structure of the left tibia at the mid-portion by a grayish-white, firm, soft tissue, with a necrotic center filled with mucopurulent fluid. The bone at this point was extensively infiltrated, and there was a pathologic fracture of the remaining lateral shell of the tibia.

The tumor mass was cleaned out, the bony cavity curetted and packed with gauze, a posterior molded plaster splint was applied and the patient returned to the ward in good condition.

Microscopic examination of the removed tissue showed it to be plexiform epithelioma of the same type as that previously found in the cervix.

Further radium therapy was suggested but the patient refused treatment and left the hospital on her own accord. Our social service worker followed the case at the patient's home and reported her condition as progressively becoming worse. The patient was last seen in July, 1931, at which time she was very weak, was unable to leave her bed, and the leg was considerably swollen and painful.

CONCLUSIONS

1 Metastases in the long bones are often overlooked and are attributed to inflammatory lesions.

2 In cases of carcinoma of the cervix, periodic roentgenographic study of the long bones should be done.

3 While distant metastases from carcinoma of the cervix uteri are rare, one should consider the possibility when the patient exhibits symptoms of tumor growth elsewhere in the body.

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PACK FOR USE IN APPLYING RADIUM TO THE SOFT PALATE

By JOHN S. WILSON, M.D.,
Mack Wilson Hospital, MONTICELLO, ARKANSAS

Recently we were called upon to treat an elderly man who presented extensive carcinoma of the under surface of the posterior part of the soft palate. The lesion had apparently extended well into the tissues of the palate and our only hope was to give the lesion a heavy dose of well filtered radium. Attempts had been made to administer radium by having the patient hold a pack on a tongue depressor, but he would not, or could not, keep it in place.

Applications were made to the upper surface of the soft palate through two heavy catheters, each carrying 50 mg of radium, which were passed back through the nares until they emerged in the pharynx. Filtration was through monel metal needles, which contained the radium, filtered through 1 mm brass, and the catheters, which were 2 mm thick. This application gave us the dosage we felt the lesions of the upper surface should have.

The next and greater problem was to bring radium in contact with the lesion on the under surface of the palate and to keep it there sufficiently long to deliver the necessary dose. After many attempts, we improvised the little device shown in Figure 1.

The dental modeling compound of which it was made was shaped to fit the lesion, be-

cosis, notable among whom are Crottı, Virchow, Gluck, Wiens, Wever, Kaufmann, Rossle, Hart, Halsted, and others. Another reason why radiation therapy has been uniformly successful in the treatment of thyrotoxicosis is the accuracy with which it can be administered. Ingenious scientific instruments have been devised, the result of years of scientific investigation and experimentation, which accurately measure the quantity and quality of the dose prescribed by the radiologist for his patient. A unit of measurement has been accepted internationally, known as the r unit, which is understood alike in all countries. In this manner, the language of the radiologists throughout the world is the same. A competent radiologist can duplicate with little difficulty any technic in radiation therapy anywhere. The bureaus of standards of most countries are prepared to calibrate such instruments in the r unit, so that when it is said a patient has been given 300 r units, it is known definitely the quantity of radiation received by the patient. In other words, this form of therapy is standardized and accounts for the uniform results obtained by radiologists in the treatment of toxic goiter.

In a statistical study of the results obtained in the treatment of toxic goiter by means of radiation therapy, by radiologists of varying experience in goiter therapy throughout this country, 10,541 cases have been treated with a favorable percentage of cures and a low percentage of failures. Of this group, operation had previously been done upon 980. No doubt, many of these cases had been operated on by surgeons unskillful in goiter surgery. It is unfortunate that this must happen, and that it will perhaps continue for some time, but not all surgeons have attained to a uniformly high degree of skill. Others were operated on by skillful and experienced surgeons. The failures may be accounted

for on the basis of an accompanying thymic involvement, as many of these operative failures are cured by radiation therapy. In this regard, Crottı states that he routinely explores the upper mediastinum following thyroidectomy, and removes the thymus whenever it is found. It is his opinion that not only are the remote results of operation better, but that the operative course is more satisfactory.

Certain criticisms have been made against reporting goiter cases as improved. It is the belief of some that these cases, because they are not cured, must be classified as failures. We heartily agree with such criticisms when applied to surgical statistics, as the surgical and radiologic treatments are so different. In the instance of surgery, either the operation is a success or a failure, either too little or too much of the gland has been removed. Nevertheless, in radiation therapy, patients may receive a few treatments which improve their condition to such an extent that they believe themselves cured and desert before the treatment is completed. Others are advised by the referring physician to discontinue treatment, as they are considered by him as cured. In such instances they were markedly improved but not cured. Then again, patients after receiving one or two treatments, finding that they have not been cured, may fail to return. Most often, however, patients being treated by radiation therapy fall into a surgical atmosphere of persuasion, which naturally results in an operation. Many such cases were already markedly improved at the time of operation. A large number of these cases would have resulted in cures, and others, perhaps, in failures had they persisted with their treatments. It can be said in all fairness that at least one-half, or perhaps more, of the markedly improved patients, had they continued their treatment, would have been classified as cured and the others as failures. We can agree with

EDITORIAL

LEON J MENVILLE, M D
BUNDY ALLEN, M D

Editor
Associate Editor

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THE TREATMENT OF TOXIC GOITER

Because of the prevalence of toxic goiter in this country, and also because of the divergent opinions as to the best and safest method in treating this disease, a symposium appertaining to this subject was held at the last meeting of the Radiological Society of North America.

The purpose of such a symposium is primarily educational. It offers an opportunity to present the most modern advance made in the treatment of a certain disease by some particular method or methods, also—which is of importance—it correlates the results obtained by physicians of varying experience in their own specialty, and not by a few outstanding physicians with large experience, connected with some renowned medical center.

We are presenting to our readers in this issue of RADIOLOGY a symposium on the treatment of toxic goiter by radiation therapy, surgery, and internal medicine. Those physicians participating are well known to the members of their own specialties, and have acquired experience and knowledge in the treatment of this disease. For this reason, this symposium should be representative of the present-day results obtained in the treatment of toxic goiter by the methods named.

For years, the principal forms of treat-

ment used in toxic goiter were medical and surgical. Good results were being reported by surgeons. The percentage of cures was most gratifying, although the death rate was high. Improved surgical technic and greater experience in goiter surgery were the causes of a marked reduction in the mortality rate. In fact, to-day, in a few large surgical centers, where expert goiter surgeons operate, the mortality is less than 2 per cent. However, we must appreciate that this low mortality is not representative of that of the general surgeon. It is said that at present the surgical mortality following goiter operation by the general surgeon is about 10 per cent. This high mortality has given the medical profession much concern. It was hoped that some other form of treatment could be used in conjunction with surgery, or alone, which would produce a high percentage of cures with a negligible mortality. Radiation therapy is now ideally fulfilling this hope, and the results obtained by its use in carefully selected cases are far beyond the highest expectations of the medical profession.

There are several reasons why such excellent results are being obtained. One is that in treating the thyroid gland the thymus gland is also irradiated. It has been known for some time that certain changes occur in the thymus gland of patients suffering with thyrotoxicosis. Experiments have shown that after thymectomy in animals the thyroid gland tends to become hyperplastic as in Graves' disease, and likewise following thyroidectomy the thymus becomes hyperplastic. Many outstanding investigators have been emphatic in their belief that there exists a relation between hyperplasia of the thymus and thyrotoxi-

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continuing stimulus to investigators in those subjects having a direct bearing on the advancement of clinical science

MINNESOTA RADIOLOGICAL SOCIETY

The winter meeting of the Minnesota Radiological Society was held at the University Hospital in Minneapolis on Saturday, February 13, 1932. The following program was presented

CLINICAL-PATHOLOGICAL-RADIOLOGICAL CONFERENCE

Conducted by W A O'BRIEN, M D

Assisted by B PEARSON, M D, O RANDALL, M D, and R KOUCKY, M D

1 Ewing's Sarcoma of Bone

Discussion by W Cole, M D, and C Hansen, M D

2 Multiple Myeloma, with Intestinal Obstruction

Discussion by O H Wangensteen, M D

3 Carcinoma of Breast, with Multiple Metastases

Discussion by K Stenstrom, Ph D, O Campbell, M D, and L G Rigler, M D

4 Carcinoma of Antrum, with Peripheral Metastases

Discussion by W Peyton, M D, and K Stenstrom, Ph D

Relative Value of Stereoscopic and Single Films in the Routine Examination of the Chest

Frederick B Exner, M D

Studies on the Routine Examination of the Chest in Students

Harold Diehl, M D

Anomalous Lobes of the Lungs

L G Erickson, M D

Observations on Intra-pleural Pressure in Massive Pulmonary Atelectasis

Rudolph Koucky, M D

Radiation Therapy of Neuritis

John J Eneboe, M D

Fractures of the Sesamoids

Jacob Sagel, M D

Methods of Radiation Therapy of Carcinoma of the Esophagus

C O Hansen, M D

Intraperitoneal Herniae Preliminary Report

Frederick Exner, M D

The Use of Thorotrast in Roentgen Diagnosis Preliminary Report

L G Erickson, M D

ADDRESSES

The Recent Literature on the Classification and Treatment of Bone Tumors

W A O'Brien, M D, Professor of Pathology, University of Minnesota

Cholecystographic Studies on the Emptying of the Human Gall Bladder

E S Boyden, M D, Professor of Anatomy, University of Minnesota

The next meeting of the Minnesota Radiological Society will be held in St Paul, May 23, 1932

INDIANA ROENTGEN SOCIETY

The Indiana Roentgen Society held its fifth annual meeting in Indianapolis on the 22d of February. H P Doub, M D, of Detroit, was the speaker.

The following officers were elected
President-elect, R L Lochry, M D, of Indianapolis,
Vice-president, H W Sigmond, M D, of Crawfordsville,
Secretary and *Treasurer*, J N Collins, M D, of Indianapolis

MEDICO-LEGAL NOTE

If members of the Radiological Society who have been—or are in the fear of being

the critics that a given patient with toxic goiter, who abides by all the directions of the radiologist and receives the required number of treatments which would ordinarily constitute a cure, and is still only benefited, should be classified as a failure.

Radiation therapy in the treatment of toxic goiter has been the means of preventing a most distressing post-operative complication, namely, psychosis. This not infrequent complication is one to which a large number of patients suffering with exophthalmic goiter are susceptible. Its importance is emphasized by a prominent American goiter surgeon who says, "The incidence of post-operative psychosis is rather higher in thyroid surgery than in operative work in other regions of the body, due to the peculiar mental state of the toxic patient. Some physicians hold that individuals who develop exophthalmic goiter are mentally predisposed to the condition."

It would be unfair to say that surgery does not produce splendid results in the treatment of toxic goiter when performed by a skillful and experienced surgeon. Nor can there be a denial of the fact that there are too many failures and deaths as a result of operation by the general surgeon, who is skillful in other fields of surgery but lacks proper experience. Certain toxic goiters are best treated by surgery and such cases should be referred to surgeons by roentgenologists, on the other hand cases in which radiation therapy is indicated should be referred to radiologists. "Render unto Cæsar the things that are Cæsar's."

York City, as the recipient of the John Phillips Memorial Prize for 1932.

This prize, an annual award by the College in the sum of fifteen hundred dollars, is given to perpetuate in the College the memory of Dr. John Phillips, of Cleveland, a man of outstanding accomplishments as investigator, teacher, and physician, for many years a member of the Board of Regents of the American College of Physicians, who gave his life in saving others on the occasion of the Cleveland Clinic disaster on May 15, 1929.

The Committee on the John Phillips Memorial Prize, through its Chairman, James H. Means, M.D., of Boston, recommends the award, "To Dr. O. T. Avery for the series of studies upon the *Pneumococcus*, in which he has played a leading rôle, beginning with the discovery of the type-specific soluble capsular polysaccharides and culminating in the discovery of a bacterium producing an enzyme which splits the polysaccharides of Type 3 Pneumococcus *in vitro*, thus rendering it susceptible to phagocytosis and thereby protecting the animals infected with it."

The Sixteenth Annual Clinical Session of the College will be held in San Francisco during the week of April 4, 1932. Dr. Avery will deliver an address, "The Rôle of Specific Carbohydrates in Pneumococcus Infection and Immunity," at the Convocation on Wednesday evening, April 6. At the conclusion of Dr. Avery's address, the prize will be presented to him by S. Marx White, M.D., of Minneapolis, President of the College.

The distinction of this award is enhanced by the fact that, although it was available the previous year, it was not possible to decide on a suitable recipient. This is, therefore, the first award made. It is the hope of the officers and members of the College that this annual prize in memory of a distinguished colleague may, by recognizing merit, be a

COMMUNICATIONS

AMERICAN COLLEGE OF PHYSICIANS TO AWARD PRIZE TO
O T AVERY, M D

The American College of Physicians recently selected O. T. Avery, M.D., of the Hospital of the Rockefeller Institute of New

- 4 In large cavernous types is heavy filtration with distance preferable?
- 5 Should dosage be applied slowly over long periods of time, or are large initial doses as desirable?

Squamous-cell Carcinoma of Skin

- 1 Do you use unfiltered X-ray in these lesions?
- 2 Do you use filtered radium exclusively?
- 3 Do you regard the Regaud type of technic preferable in these lesions?
- 4 What percentage do you regard as curable by radiation?
- 5 Do you consider radium preferable to roentgen ray in these lesions?

Basal-cell Carcinoma of Skin

- 1 Do you believe it justifiable to treat these lesions with roentgen ray alone? With radium alone?
- 2 Have you had experience in treating these lesions with radium, giving large doses by using small amounts of radium heavily filtered, over a long period of time (as Regaud method)? If so, have not your results from this method been as good as published surgical results?
- 3 In large infected lesions (either squamous or basal cell) would you advise immediate electrosurgical removal? Would you follow this by post-operative radiation or would you allow the area to heal and then treat recurrences with radiation if they appeared?

INTRAO-RAL MALIGNANCIES

Lip

- 1 Do you believe practically all local malignancies on the lip are curable by radiation?
- 2 Do you believe radium preferable to X-ray for the primary lesions on the lip?

- 3 Do you use small amounts of heavily filtered radium applied over long periods of time in lip lesions?
- 4 Do you apply radiation to neck gland areas routinely in all lip malignancies? If so, do you produce a single erythema or use the saturation method?
- 5 Do you use gold implants alone in neck nodes or do you believe a combination of implantation and surgery is better?

Floor of Mouth, Cheeks, and Tongue

- 1 In these lesions are gold radon implants or heavily filtered (1 to 2 mm of platinum) surface applications preferable?
- 2 Do you consider radium alone superior to electrocoagulation in intra-oral lesions?
- 3 Would you advise a combination of these methods?
- 4 Do you take biopsy before instituting radiotherapy?
- 5 Is your radiotherapy influenced by the histological picture of the primary tumor? In other words, does the type of your treatment depend upon the pathologic findings or are all types treated with the same set-up? This refers to radiosensitivity based on the histological picture

Pharyngeal and Tonsillar Malignancies

- 1 Do you precede the local application of radium to these lesions by external high voltage X-ray to sides of neck?
- 2 Method of treatment of local lesions—gold seeds or heavily filtered surface packs?

LARYNGEAL MALIGNANCIES

Intrinsic Malignancies

- 1 Is radiation justifiable here or should total laryngectomy be done?

—harassed into answering hypothetical questions while on the witness stand as ordinary witnesses will send me a stamped addressed envelope, I will be glad to send them some really desirable and illuminating information

This offer is strictly limited to members of the Society, and then only "*Janus clausis*"

I S TROSTLER, M D

QUESTIONNAIRE FOR COMMITTEE ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION CAN- CER COMMISSION

The following questionnaire is being submitted to the radiological members of the California Medical Association Cancer Commission. Since radiology is playing a not inconsiderable part in the solution of the cancer question it may not be amiss to suggest to the readers of *RADIOLOGY*, everywhere, to send their replies to this inquiry to William E Costolow, M D , of Los Angeles. It is far too valuable a study to be confined to the members of one State association. Besides, it suggests itself as an interesting opportunity for a man to take measure of his methods and record his trials and successes

GENERAL

- 1 Name minimum requirements for equipment in radiation therapy for malignancies
 - (a) Roentgen ray in superficial malignancies—in deep malignancies
 - (b) Radium in superficial malignancies—in deep malignancies
- 2 What is your routine low voltage technic in superficial malignancies as to

Voltage,
Filtration,
Skin distance,
Total skin erythemas applied

- 3 What is your routine high voltage technic in more deeply situated malignancies as to

Voltage,
Filtration,
Skin distance,
Total skin erythemas applied

- 4 Do you use saturation methods (as outlined by Pfahler) or some other method in maintaining dosage in tumors over a period of time?
- 5 In high voltage technic for deeply situated tumors, do you measure your patient, plotting the tumor by cross-section anatomical charts (as Weather-wax technic) and compute the percentage of skin dose which the tumor receives?
- 6 Do you measure all your roentgen-ray dosages in r units by ionization methods?

SKIN

Keratotic Lesions

- 1 Is the Grenz ray sufficient?
- 2 Is X-ray alone the method of choice?
- 3 Should radium be used?
- 4 Are electrosurgical methods preferable?

Moles
- 1 In what types is radiation indicated?
- 2 How should melanotic moles be treated?
- 3 Have you seen any five-year cures in melanotic carcinoma?

Angiomas

- 1 Is X-ray indicated? If so, in what types?
- 2 Do you consider radium treatment the method of choice in all cases?
- 3 Should Beta rays of radium be utilized by using light filtration of radium, or should heavy filter (e.g., 1 mm platinum) be used?

- (g) Any other types
- 2 Number and percentage of palliative improvements?
 - 3 Number and percentage of five-year cures?
 - 4 Would you always advise pre-operative radiation in all bone tumors in case operation is to be performed?
 - 5 How long a time interval between radiation and operation would you advise?
 - 6 In treating bone tumors by high voltage X-ray, have you used heavy filtration (1½ to 2 mm Cu), applying moderate dosage over a long period of time by some type of saturation method?

**LYMPHOGRANULOMAS (HODGKIN'S,
LEUKEMIAS)**

- 1 Have you used heavily filtered radium packs in these cases, treating multiple areas in a short period of time?
- 2 Do you use small doses of low voltage radiation therapy in these cases, followed by high voltage later when the cases seem to be becoming radio-resistant?
- 3 Have any of your cases in this group failed to show palliation following radiation?
- 4 Have any cases of acute leukemia shown temporary improvement or palliation?
- 5 Do you believe radiation definitely prolongs life in Hodgkin's disease? In leukemia?
- 6 Approximately what prolongation of life have your cases shown over average figures given in the literature?

GENITO-URINARY—MALE AND FEMALE

Testicular Tumors

- 1 Do you advise pre-operative radiation to the primary lesion followed by complete removal?

- 2 How long an interval between completion of radiation and radical removal?
- 3 Do you believe, from your experience, that radiation is superior to any operative interference on the abdominal lymph gland metastasis?
- 4 Have you seen five-year cures following radiation of the abdominal lymph gland metastasis?
- 5 Approximately how many?

Kidney Tumors

- 1 Have you seen any five-year cures from radiation alone in kidney tumors?
- 2 Would you advise pre-operative radiation of kidney tumors? Post-operative radiation?
- 3 In inoperable kidney tumors have you observed appreciable palliative effects from radiation, as—
Lessening of pain?
Lessening of hemorrhage?
Diminution of size of growth?

Bladder Tumors

- 1 From experience, would you advise pre-operative radiation of bladder tumors by means of high voltage X-ray?
- 2 Do you consider electrocoagulation accompanied by implantation of gold radon seeds, followed by high voltage X-ray therapy, as the best technic in treating bladder malignancies?
- 3 Could you suggest another more desirable technic?
- 4 Have you seen five-year cures from radiation treatment alone in bladder tumor cases? Approximate number?
- 5 Have you seen five-year cures of bladder tumors from a combination of surgery and radiation? Approximate number?

Extrinsic Malignancies

- 1 Do you believe radiation the preferable method of treatment in these lesions?
- 2 Have you seen distinct benefit from radiation in these cases? Any cures?
- 3 Have you used the Coutard technic in these cases (heavy filter approximately 2 mm Cu, moderate doses daily over long period of time, giving large total dosage—6,000 to 8,000 r)?

CHEST

- 1 Have you seen definite five-year cures from radiation in primary carcinoma of the lung?
- 2 Have you seen a number of definite palliative results from radiation in primary carcinoma of the lung? Approximately how many?
- 3 Were all cases treated by external high voltage X-ray or did some have radium applied directly through the bronchus?

BRAIN, SPINAL CORD

- 1 Have you seen definite palliative results from radiation treatment of brain and spinal cord tumors?
- 2 In what type of tumors?
- 3 What percentage of cases showed improvement?
- 4 Any definite five-year cures?
- 5 Was high voltage X-ray therapy used exclusively, or radium?

GASTRO-INTESTINAL

Esophagus and Stomach and Intestines

- 1 Any definite palliative results from radiation? Approximately how many? What were the palliative effects? Relief of pain or retardation of growth?
- 2 Radium used alone or combined with X-ray?
- 3 Any five-year cures?

RECTAL

- 1 Do you advise preliminary colostomy before radiation?
- 2 What type of radiation
 - (a) Gold seeds
 - (b) Surface application of heavily filtered radium
 - (c) High voltage X-ray therapy, or
 - (d) A combination of these technics?
- 3 Do you precede the local application of radium with high voltage X-ray therapy?
- 4 What percentage of palliation does radiation alone give?
- 5 Does the palliation consist of—
 - (a) Prolongation of life,
 - (b) Lessening of bleeding,
 - (c) Partially destroying and retarding growth,
 - (d) Relief of pain?
- 6 Any five-year cures by radiation alone?
- 7 Number and percentage of these cures, if possible?
- 8 From experience, do you believe pre-operative external radiation, by means of high voltage X-ray, produces enough destruction of rectal carcinoma, as evidenced by palpable shrinkage of the growth, to warrant its adoption in all operable cases? Would this improvement from the external radiation be sufficient to offset the delay in operation? How soon after the radiation course would you advise operation?

BONE TUMORS

- 1 Have you seen palliative or curative results in the following bone tumors from radiation?
 - (a) Giant-cell tumors,
 - (b) Osteogenic sarcoma,
 - (c) Osteochondroma,
 - (d) Osteitis fibrosa cystica,
 - (e) Ewing's tumor,
 - (f) Metastatic bone growths,

- (g) Any other types
- 2 Number and percentage of palliative improvements?
 - 3 Number and percentage of five-year cures?
 - 4 Would you always advise pre-operative radiation in all bone tumors in case operation is to be performed?
 - 5 How long a time interval between radiation and operation would you advise?
 - 6 In treating bone tumors by high voltage X-ray, have you used heavy filtration ($1\frac{1}{2}$ to 2 mm Cu), applying moderate dosage over a long period of time by some type of saturation method?

LYMPHOGRANULOMAS (HODGKIN'S, LEUKEMIAS)

- 1 Have you used heavily filtered radium packs in these cases, treating multiple areas in a short period of time?
- 2 Do you use small doses of low voltage radiation therapy in these cases, followed by high voltage later when the cases seem to be becoming radio-resistant?
- 3 Have any of your cases in this group failed to show palliation following radiation?
- 4 Have any cases of acute leukemia shown temporary improvement or palliation?
- 5 Do you believe radiation definitely prolongs life in Hodgkin's disease? In leukemia?
- 6 Approximately what prolongation of life have your cases shown over average figures given in the literature?

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- 4 Have you seen five-year cures following radiation of the abdominal lymph gland metastasis?
- 5 Approximately how many?

Kidney Tumors

- 1 Have you seen any five-year cures from radiation alone in kidney tumors?
- 2 Would you advise pre-operative radiation of kidney tumors? Post-operative radiation?
- 3 In inoperable kidney tumors have you observed appreciable palliative effects from radiation, as—
Lessening of pain?
Lessening of hemorrhage?
Diminution of size of growth?

Bladder Tumors

- 1 From experience, would you advise pre-operative radiation of bladder tumors by means of high voltage X-ray?
- 2 Do you consider electrocoagulation accompanied by implantation of gold radon seeds, followed by high voltage X-ray therapy, as the best technic in treating bladder malignancies?
- 3 Could you suggest another more desirable technic?
- 4 Have you seen five-year cures from radiation treatment alone in bladder tumor cases? Approximate number?
- 5 Have you seen five-year cures of bladder tumors from a combination of surgery and radiation? Approximate number?

Prostatic Malignancies

- 1 Have you seen five-year cures of carcinoma of prostate from radiation treatment alone?
- 2 Do you consider interstitial application of radium to prostate through perineum (by means of steel radium element needles or gold seeds through needles) of distinctive palliative value in malignancies of the prostate?
- 3 Do you consider high voltage X-ray to be of definite palliative value in inoperable carcinoma of prostate? In what percentage of cases?
- 4 In recurrent post-operative carcinoma of the prostate?

MALIGNANCIES, FEMALE ORGANS*Vulval or Vaginal Malignancies*

- 1 Would you advise surgical or electro-surgical removal of these lesions, followed by radium and X-ray treatment?
- 2 Would you advise radium locally to these lesions (surface application or gold seeds) accompanied later by X-ray therapy over field and glandular areas?
- 3 Have you seen cases recurrent after operation cleared up, either temporarily or for a five-year period, by radiation methods?

Ovarian Malignancies

- 1 Is surgical removal of the primary tumor followed by high voltage X-ray therapy the proper procedure?
- 2 Do you believe attempted removal of metastatic masses logical?
- 3 Have you seen definite palliative results in treatment of metastatic ovarian carcinoma with high voltage X-ray? Approximate number?
- 4 Have you seen any five-year cures in the metastatic group just mentioned?

Uterine Malignancies

- 1 Do you believe all cases of carcinoma of cervix should be treated by radiation? Even small involvements limited entirely to cervix?
- 2 Do you advise high voltage X-ray treatment previous to local radium applications to cervix?
- 3 Do you use a more or less standardized method of application of radium (as Regaud or Stockholm method) or do you have a different technic of your own?
- 4 If you use your own technic, briefly describe
- 5 Give average dosage of radium and X-ray—average number of milligram-hours used? Do you follow a saturation method of high voltage X-ray with measurement of patient and computation of pelvic dosage delivered?
- 6 Do you believe individualization of cases as regards extent of the disease when computing dosage to be given is an important factor in improving end-results?
- 7 Should X-ray therapy always be used in conjunction with local radium applications to the cervix?
- 8 Should cases of carcinoma of fundus (where growth is apparently entirely confined to the fundus) always be treated by total hysterectomy?
- 9 Have you used radium pre-operatively in these cases? How long an interval between radiation and operation?
- 10 Have you seen carcinoma of fundus cured by radiation alone?
- 11 Would you advise the use of high voltage X-ray in conjunction with radium in all cases of carcinoma of fundus?
- 12 Should advanced uterine cases with extensive pelvic gland involvement be treated with small amounts of radiation

- for the palliative effect alone, or should an attempt be made to give full dosage?
- 13 What is the average amount of radium (describe filtration) you use intra-uterine in carcinoma of fundus?

THYROID MALIGNANCIES

- 1 Have you used interstitial radium applications in any case of thyroid malignancy?
- 2 Do you use high voltage X-ray alone or combined with distance radium packs?
- 3 Have you used a high voltage technic in these cases similar to the Coutard technic?
- 4 Have you seen five-year cures in thyroid malignancies? Approximate number?
- 5 What percentage of cases treated have shown definite palliative results? (Diminution of size of growth, relief of pain or pressure symptoms)

WITH REFERENCE TO BREAST CANCER

- 1 Is it ever justifiable to depend entirely upon radium and X-ray therapy in operable cases?
- 2 In your opinion, does pre-operative radiation increase the number of five-year cures?
- 3 Do you select cases or give pre-operative radiation for every breast lump before exploration?

WITH REFERENCE TO RADIATION TECHNIC

(A) Of Pre-operative Radiation

- 1 Do you use low voltage (120 to 140 KV, 4 to 6 mm aluminum filter, 25 to 30 cm skin distance) or
- 2 High voltage (160 to 200 KV, 0.5 to 2 mm copper filter, 50 to 80 cm skin distance) or
- 3 Radium interstitially in heavily filtered, small amounts of element or emanation,

, or heavily filtered (equivalent to 2 mm platinum) radium packs at a distance of from 3 to 6 cm?

- 4 Are doses given daily in small amounts over a period of time (as in Regaud and Coutard methods), or are they given in the space of a few days?
- 5 How long an interval do you advise between pre-operative radiation and operation?

(B) Of Post-operative Radiation

- 1 Do you use post-operative radiation routinely or only where known cancer is left?
- 2 Do you believe from your experience that post-operative radiation should always be used routinely?
- 3 Do you prefer low voltage technic (as already described) or the low voltage technic over the breast area, with high voltage technic to axillary and supra-clavicular areas?
- 4 Do you repeat your X-ray treatment cycle to the breast and gland areas in a few months, or do you wait until there is evidence of recurrence?
- 5 Do you consider the use of radium applied directly to nodular recurrences preferable to X-ray over the entire operative field? Is the radium used in the form of needles plunged around the nodule?
- 6 Has the combination of the two methods mentioned above proved more efficacious in your hands than either method singly?
- 7 From experience, do you believe recurrent nodules in field of operation should always be treated by radiation instead of surgery?
- 8 Have you seen a considerable number of cases with post-operative recurrences which have cleared up following radiation treatment, and remained so for a

five-year period? (Give percentage, if possible)

WILLIAM E COSTOLOW, M D, *Chairman*
1407 S Hope St, Los Angeles

R G TAYLOR, M D, *Secretary*
Radiology Committee
C M A Cancer Commission
January 9, 1932

RADIUM FOR SALE

The radium described below was the property of Henry A Chapin, M D, of Jacksonville, Illinois, whose death occurred last Winter. Mrs Chapin is desirous of disposing of the radium, and the officers of the Society are glad to offer their assistance by publishing this notice.

B S No 4518, a non-corrosive alloy needle 27.6 mm long and 1.75 mm external diameter, 12.43 milligrams of radium. B S No 4515, a non-corrosive alloy needle 26.9 mm long and 1.76 mm external diameter, 12.47 milligrams of radium. These needles were purchased from Radium Chemical Company, Pittsburgh, in August, 1921. B S No 4832, monel needle 29.13 mm long and 1.48 mm external diameter, 12.45 milligrams of radium. No 4831, monel needle 28.6 mm long and 1.50 mm external diameter, 12.40 milligrams of radium, purchased from Radium Company of Colorado, Denver, Colorado, in September, 1921.

Address all communications to Mrs Grace D Chapin, Jacksonville, Illinois

BOOK REVIEWS

DIE BEHANDLUNG DER KINDERKRANKHEITEN
MIT ULTRAVIOLETT UND RÖNTGENSTRÄHLEN
By PROF DR W BIRK, Vorstand der Universitäts-Kinderklinik in Tübingen, and DR L SCHALL, Chefarzt der Kinderabteilung am Landeskrankenhaus Homburg-Saar

Volume XVII, Sonderbande zur Strahlentherapie Second enlarged and revised edition of "Strahlenbehandlung bei Kinderkrankheiten," published in 1924 Published by Urban and Schwarzenberg, Berlin, 1932 Paper, 256 pages, and 45 illustrations Price, 12 marks

The applications of radiotherapy to the treatment of diseases in children have developed to such an extent since 1924 that the authors have felt constrained to expand and revise their text-book on "Radiotherapy in Pediatrics." This revision is so radical that, in truth, a new text has resulted. The book falls naturally into two parts first, the applications of ultra-violet, and secondly, the uses of X-rays. Schall is largely responsible for the chapters on ultra-violet, and Birk for those on X-ray, but all sections have been amended where necessary by the experience of both men, so that a real joint-authorship results.

The physical aspects of both kinds of radiation are taken up in detail, apparatus is discussed briefly, dosimetry is considered from the special point of view of its peculiarities in regard to children, and then the treatment of various diseases is illustrated in detail and amplified by a wealth of clinical histories. Throughout the whole book there is a tone of conservatism.

The opinion of the authors is that there are really three groups into which the radiotherapy of children's diseases falls according to the best data available at present. There is the first group in which radiotherapy is the method of choice, and in which cure is practically certain. To it belong tuberculosis of the peritoneal cavity, tuberculosis of the mesenteric nodes, and peripheral lymph node tuberculosis. Thymic hyperplasia also falls into this group, but the authors are inclined to doubt the existence of this lesion as a frequent or important clinical entity. In the second group radiotherapy usually produces no lasting cures but is the best method of palliation for lymphogranuloma, the leukemias, and some other blood diseases. In the third group is a series of diseases in which the value of radiotherapy is debatable, such as bronchial asthma, hypertrophy of the tonsils, diseases of the cerebral nervous system, etc.

The book should be read by all radiotherapists, who will learn much which is new, interesting, and important in this specialized field, and merits serious consideration by pediatricians, to whom is presented much information of value, both in regard to indications for radiotherapy and the results to expect from it.

As is usual with the publishers, the make-up of the volume is first-class.

E T LEDDY, M D

WILHELM CONRAD RÖNTGEN AND THE HISTORY OF ROENTGEN RAYS (UND DIE GESCHICHTE DER RÖNTGENSTRÄHLEN)
By OTTO GLASSER, PH D, Cleveland Clinic Foundation, Cleveland, Ohio
With personal recollections by MARGARET BOVERI, Berlin Pages, 337, with 96 illustrations Published by Julius Springer, Berlin, 1931 Price, 27 marks, bound, 29 60 marks

Years ago I suggested to Glasser that the writing of a biography of Roentgen was a work for his hand, and now, as the spiritual father of the idea, I welcome this child into the world of literature. This book, "Wilhelm Conrad Rontgen und die Geschichte der Rontgenstrahlen," is the story of Roentgen's life and of the eventful year of 1896. It contains a contribution from the pen of Margret Boveri, daughter of Professor Theodore Boveri, a life-long and intimate friend of Roentgen's.

The book begins with the account of the discovery, as given by Roentgen to H J W Dam (sent by "McClure's Magazine" to interview him), and published in April, 1896, in "McClure's Magazine."

The incident of the book and the key as related by T S Middleton, a student at the Wurzburg University at the time Roentgen made his discovery, finds no credence in Glasser's estimation. Glasser discounts it completely. But why might it not have occurred? There is the episode of Archimedes rushing out of his bathtub crying, "Eureka!", there is the story of Newton and

the apple, of Einstein, to whom the pivotal idea of the relativity theory came in a dream when he had almost decided to abandon it. Perhaps the explanation of the key image on the photographic plates did lead him to search further. Who knows? Professor Goodspeed, of Philadelphia, had noted in 1890 strange images on photographic plates, exposed to Crookes' tubes, five years before Roentgen's discovery, and had left these mysterious markings unexplained, but Roentgen, as he assured MacKenzie Davidson, did not wonder, but investigated. Perhaps the incident did not occur. What do the Italians say, "Se non è vero, è ben trovato"?

Glasser gives in detail the story of Roentgen's life and of his scientific achievements. Margret Boveri then picks up the tale and tells of his youth, his university life, his reaction to war, politics, science, and art and the last sorrowful years of his life. There are many of Roentgen's letters which enable one to look into his mind and judge the motivating ideas of his life. He believed in truth and sought for it, in every phase of his experience, in his scientific work, and in his daily life. He believed in his fellowmen and tried to serve them. But how he hated bigotry and religious intolerance and what a contempt he had for unfounded scientific generalizations!

It is fashionable in the literary world, at the present time, to write biography, but biographies which are in reality fiction or, at any rate, belong to the rapidly increasing class of publications known as novelized biographies. The method in this form of literature is to omit all deeds or events in the subject's career not susceptible to emphasis, but to magnify everything that can be made sensational.

Here is a life, however, which needs no novelization to make it interesting. It has all the essential elements of drama. Here

is a modest, methodical, painstaking physicist living in the peace of the library and laboratory, leading the orderly regulated life of a teacher of physics in a small German university, who suddenly discovers a curious phenomenon, a phenomenon so strange and so startling as to be almost unbelievable, a phenomenon which proves to be of such tremendous import as to shake the world of physics to its very foundation. He announces the discovery, and an astonished world grasps at once the import of it and showers him with honors and approbation, yet he remains as before, a modest, retiring, simple, unassuming student of Nature, happy in the circle of his friends and family, desiring all for science and but little for himself. Then comes the war and its aftermath, engulfing him in its tragedy and making of him, in the end, a sad and lonely figure.

Glasser's description of the reaction of the daily press to the discovery is full and complete and contains an account of the discovery as reported in the scientific journals, and the description of the first magazine dealing with roentgenology, the "Archives of Skiagraphy," published in 1896. Then follow Roentgen's first two papers, the beginnings of fluoroscopy, the early application of X-rays in medicine, the early diagnostic X-ray literature, the first observations on the therapeutic use of the X-ray, the development of the X-ray tube and energizing apparatus intensifying screens, the beginning revolutionary changes in the world of physics, the use of the X-ray in the arts, the discovery as viewed by the comic press, and letters from pioneer workers recounting their early experience with the newly discovered ray. The book closes with the third contribution of Roentgen in May, 1897, "Further Observations on the Characteristics of the X-ray."

Many interesting illustrations taken from early publications on the X-rays and numer-

ous pictures of Roentgen and his family and friends add to the value of this work. It is apparent that Glasser does not like the bust the sculptor Hildebrand made of Roentgen, for he does not show a picture of it. His friend Boveri thought it admirable for he writes to Roentgen "I find the likeness and expression wonderful and think that this bust belongs to Hildebrand's best work. One sees in it clearly a labor of love and joy. How marvelously the brow is modelled! The attitude of the head and the expression of the eyes are beyond criticism."

I think this extraordinary work is the very epitome of spiritual grandeur and beauty. It is certainly superior to all the studied photographs of Roentgen extant, most of which are reproduced in the book.

The volume is filled to the brim with facts gathered through great industry and effort. It is an extraordinary piece of research work of its kind. Unfortunately, it lacks an index. Rather pedantic and sophomoric in its literary style, it is nevertheless written with great sincerity and a burning enthusiasm, which a worker in this field finds difficult to avoid, knowing the great import of the discovery and the revolutionary changes it has wrought.

From the extraordinarily complete data some one will some day write a fascinating story of the events which transpired in the world of physics in the year 1896, after the discovery which Roentgen made on that fateful Friday evening of November 8, 1895, and of which he said to Boveri a few days later, "I have discovered something interesting, but I do not yet know whether my observations are correct."

I S H

l'Académie de Médecine Published by Masson et Cie, Paris, 1931 Pages 266 and 71 plates Price, 40 francs

This is one of several works which constitute the library on phthisiology published under the editorship of the author himself. The book is an attempt to bring together and to analyze the extensive body of knowledge relating to pulmonary tuberculosis, which has accumulated during recent years as a result of numerous developments in roentgenology, bacteriology and serology, experimental and social medicine, surgery and chemotherapy. In no sense a treatise or text-book, it is, primarily, the expression of the personal studies and experience of the author, who, by reason of his position as a teacher, his extensive clinical experience, and his previous writings, is known as one of the leading authorities in the field. Throughout the work, one is impressed by breadth and soundness of judgment, and by the critical sense with which the clinical, pathologic, and roentgenologic factors are evaluated and correlated. The book is well printed and contains many half-tone reproductions of roentgenograms which are well selected to illustrate the features described.

The twelve chapters deal with present ideas on the development of pulmonary tuberculosis, the onset of primary infection at different ages, the onset of recurring tuberculosis in the intercleido-hilar, parahilar, basilar, parietal, and apical portions of the lungs, the correlation of roentgenologic images or signs of tuberculosis in the different localizations previously mentioned, the lobar variety of onset, onset by diffuse miliary extension, the so-called typhobacillary form of onset, the arrest of primary infection and of recurring infection, as well as a discussion of tuberculosis as it affects, or is affected by, marriage.

To any one interested in pulmonary tuberculosis, either from the clinical or roentgenologic standpoint, this work must be of decided interest and value.

PHYSICS AND ELECTRICITY (PHYSIK UND ELEKTRIZITÄTSLEHRE) By DR. ROBERT JAEGER, Regierungsrat bei der Physikal-Technik Reichsanstalt, Berlin. With an In-

trodition by Oberregierungs- und Ober-medizinalrat DR. WALTER LUSTIG, Berlin. A handbook for the doctor and technician of laboratory technic and roentgenologic methods, edited by DR. WALTER LUSTIG. Volume V, 175 pages (paper volume), with 289 illustrations. Published by Fischer's Medizinische Buchhandlung, Leipzig, 1931. Price, 9.80 marks.

It is a very difficult task indeed to write a brief text-book on physics for readers who are not familiar with calculus, particularly with differential equations and integration. The author will find himself compelled either to sacrifice to a certain degree the accuracy aspired to by the full-fledged physicist or to write "over the heads" of his students. After reading the book of Jaeger I must confess that he has succeeded remarkably in satisfying both requirements. In 168 pages the fundamentals of mechanics, of solid bodies, liquids and gases, acoustics, heat, optics and electricity are outlined and illustrated by simple diagrams. Practical references in the various chapters as, for instance, to the mechanics of joints, the clinical thermometer, sphygmomanometer, the microscope, medical lamps, electrocardiogram, ionization instruments, and diathermy apparatus render the book most suitable to the novice in medicine or the apprentice in the X-ray and clinical laboratory. The last two chapters deal with practical problems in electricity which should be of interest to anyone working in an X-ray laboratory.

The author, who is a member of the staff of the German Bureau of Standards in Berlin, has presented us with a brief but concise book for the beginner in physics, which is recommended particularly to teachers of X-ray and laboratory courses as a helpful guide in arranging their class work.

GYNECOLOGICAL ROENTGENOLOGY A roentgen atlas of the female generative organs, with special reference to uterosalpingography, an outline of gynecology in its relation to roentgenology, and a chapter on radium therapy. By JULIUS JARCHO, M.D.,

F A C S , attending gynecologist and obstetrician, Sydenham Hospital, New York
Pages 650, illustrations 273, and 5 colored plates (cloth volume) Published by Paul B Hoeber, New York 1931 Price \$20 00

This book is particularly interesting as the first attempt, in this country at least, to compile and co-ordinate all the work that has been done in gynecologic roentgenology. It is the more significant since the advent of uterosalpingography and its combination with pneumonography. The author has quite thoroughly gone over the literature, which is represented in an adequate bibliography. He presents a rather lengthy, although interesting, historical sketch of the entire field, presenting in detail—perhaps too much—the steps that were taken before the present stage of progress was reached. A few additional drawings or cuts would have demonstrated the older apparatus to more advantage than a lengthy and rather difficult description.

There is an excellent discussion of the Rubin test, both in the original and in the most recent modifications. The test is evaluated against the intra-uterine iodized oil instillation, both as to its demonstration of tubal patency or non-patency, and the determination of the point of obstruction when such is present. The author favors the newer procedure, citing examples of tubes impervious to gas and patent to iodized oil, and discusses the relative reliability of diagnosing a point of tubal stricture by reference of pain, as against actual visualization.

The technic of uterosalpingography is presented in some detail, with sketches of the necessary apparatus. Again, more drawings or cuts could be used to advantage. There is a reasonable conception of indications and contra-indications to this and the other procedures, with a special effort to allay the fears of ultraconservative operators. The book contains a very interesting and fairly complete series of uterosalpingographs, with their interpretations and also the clinical findings. This is the more valuable because of a well written chapter on the physiology of the uterus and tubes as brought out by iodized oil and serial examination. The combined method

receives approbation but hardly adequate treatment. Very few illustrations of pathologic conditions, as exhibited by this method, are shown. The author discusses the method of Béclère, placing a lead wire about the limits of a palpable tumor before radiographic examination, to outline the tumor on the films. Besides the restriction of this method to tumors of considerable size, or convenient location, the element of possible faulty projection of the shadow of the wire relative to that of the intra-abdominal structures enters. The combined method (pneumoperitoneum plus iodized oil instillation) appears, by all odds, to be more simple, accurate, and graphic.

The therapeutic value of intra-uterine insufflation by gas and instillation of iodized oil is presented in detail, together with representative case studies. There is also a short discussion of radiation in gynecology.

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The reviewer, however, would like to call attention to the composition of the book which, at this day should be taken into consideration, namely, the unusually large type such as is used in grade school primers, and which is quite uncalled for, making the book at least half again as large as need be. Nowhere are there higher priced volumes than roentgen publications, and the price of this volume is no exception.

PRECIS DE PHYSIOTHERAPIE ET DE PETITE CHIRURGIE DERMATOLOGIQUES By JEAN MEYER and JEAN SAIDMAN, with the collaboration of ROBERT GIRAudeau Preface by H GOUGEROT Professor of Dermato-

syphilography at the Faculty of Medicine of Paris, Doctor at Saint Louis Hospital Published by Gaston Doin & Cie, Paris, 1931 Pages 200, figures, 24 Price, 38 francs

This book is an exhaustive treatise, but is intended to help general practitioners in dealing with certain skin affections and in knowing the forms of treatment best adapted to certain cases. Moreover, the book is not an evaluation of methods employed by other workers, but is strictly confined to a brief description of the methods employed by the authors themselves. Among the therapeutic agencies considered are high frequency currents, including surgical diathermy, ultra-violet irradiation in its different forms, infra-red rays, roentgen rays, radium, cryotherapy, and hot air. Much more attention is given to the use of high frequency currents and ultra-violet rays than to any other method. For instance, the general considerations on radium are covered in three pages. The section dealing with the general aspects of roentgen-ray treatment is somewhat more adequate. In connection with radiodermatitis, no mention is made of late lesions occurring from six months to three or more years after irradiation. The authors also fail to mention the fact that secondary infection plays such an important rôle in the slow healing of radiodermatitic ulcers. They seem to favor ultra-violet irradiation for keloids, although it is well known that roentgen rays or radium are more effective. The same is true of furuncle and other infections of the skin. As a general guide the book is useful, but with reference to certain conditions, such as those mentioned, the therapeutic recommendations can hardly be said to represent the soundest opinion. Also, the descriptions of the technic of treatment given in relation to many conditions are altogether too brief.

ROENTGEN STEREOSCOPY IN PULMONARY DISEASES (RONTGENSTEREOSKOPIE BEI LUNGENKRANKHEITEN) By DR W KREMER, Dirigierender Arzt an den Beelitzer Heilstalten und Leiter des Tuberkulosekranken-

hauses, and DR W LUEDKE, Assistenzarzt am Tuberkulosekrankenhaus der Beelitzer Heilstalten No 40, Tuberkulose-Bibliothek, Beihefte zur Zeitschrift für Tuberkulose herausgegeben von Prof Dr Lydia Rabinowitsch Paper-bound volume, 35 pages, with 23 illustrations, 8 of which are colored. Published by Johann Ambrosius Barth, Leipzig, 1931 Price, 375 marks

Dr Kremer and Dr Luedke go to great pains and unusual lengths to establish the *rationale* of pulmonary stereoröntgenography. They show that stereoscopic procedure has advantages and disadvantages. Of the latter, they mention (1) the inability of many persons, especially physicians, to see stereoscopically, (2) the lack of artistic plasticity in stereoscopy because of the lack of colors, shades, air perspective, etc., and (3) the technical difficulties, especially the short exposure technic. As for the advantages, they mention the value of stereoscopy.

- 1 For diagnostic purposes in differentiation
 - (a) between intra- and extra-thoracic pathology, especially of gland shadows,
 - (b) of rib pathology (osteomas) and intrapleural pathology (cavities),
 - (c) between pleural and intrapleural processes (Cova's "tortoise-shell pleuritis," cavities, and annular shadows),
 - (d) of vascular and hilus shadows
- 2 For use in operative intervention
 - (a) as to localization of foreign bodies,
 - (b) for Jacobaeus' operation,
 - (c) for localization of cavities for thoracoplasty,
 - (d) for abscess operations

The remainder of the pamphlet is devoted to the evaluation of various types of apparatus and a discussion of the history and applicability of the anaglyphic process. There are eight illustrations of chest pathology and the accompanying anaglyphic duplicates, which are shown to support their contentions.

The first main point made by the authors—the necessity and value of pulmonary stereoröntgenography—is one which was recognized in this country long ago. The second

F A C S , attending gynecologist and obstetrician, Sydenham Hospital, New York Pages 650, illustrations 273, and 5 colored plates (cloth volume) Published by Paul B Hoeber, New York 1931 Price \$20.00

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The roentgen cataract has its form similar to that seen in the glassblowers' cataract. It may appear as early as four months, but more often it makes its development two to three years after the treatment. One case has been reported as late as eight years. The smallest recorded dose which has resulted in a cataract was 110 per cent of the skin erythema dose. However, patients who are suffering from skin diseases, such as lupus, eczema, and other similar lesions are especially sensitive, as well as patients who are poorly nourished. A larger total dosage of roentgen therapy can be received by the orbit without the production of cataract, provided the doses are partitioned. For instance, 1,200 roentgens given over four weeks are required to produce a typical roentgen cataract in experimental work on animals, whereas 1,000 roentgens will produce the same damage if given in one treatment. The main precaution to observe is that epilation must not occur.

JAMES T CASE, M.D.

PULMONARY SYPHILIS IN ADULTS (DIE LUNGENSYPHILIS DES ERWACHSENEN) By DR L DÜNNER, ärztlicher Direktor, DR F LEESER, Röntgenologe, and DR H BLUME, Assistenzarzt am städtischen Hospital Buch-West in Berlin No 41, Tuberkulose-Bibliothek, Beihefte zur Zeitschrift für Tuberkulose herausgegeben von Prof Dr Lydia Rabenowitsch. Paper-bound volume, 52 pages, with 37 illustrations. Published by Johann Ambrosius Barth, Leipzig, 1931. Price, 6 marks.

The monograph of fifty-two pages by Dr Dunner, Dr Leeser, and Dr Blume on pulmonary syphilis is characterized by an intense caution. A careful and evidently exhaustive review of the literature as well as the study of cases in their own experience makes them highly circumspect in giving a positive diagnosis of lung syphilis. The book is divided into a number of sections or chapters, the titles of which show the encyclopedic approach followed in the presentation. Under the heading of "Generalizations concerning Syphilis," the authors mention the work of Rothschild, in which he claimed to have diagnosed syphilis in the secondary stage and even some cases

during the incubation period. They feel that tertiary syphilis only is demonstrable. They stress the prevalence of confusion in the differential diagnosis of pulmonary syphilis and other chronic diseases. A statistical review of the number of cases proved at autopsy shows great divergence. They attribute this either to geographic discrepancies or to the inexperience of the examining pathologist. Skill in the pathologic diagnosis of lung syphilis would account for the findings of Rossle, who demonstrated twenty-five cases from autopsy material seen by him during his service in Jena. These were cases which had not been suspected clinically. After discussing history, symptomatology, diagnostic means, and pathology in general terms the authors indicate that the material which is to follow will prove that, after all, there are but two dependable diagnostic points, namely, the persistent failure to demonstrate tubercle bacilli in the sputum, and the localization of the lung process in the middle or lower lobes, especially on the right side. They add that a third point may be admissible also in certain types of cases, namely, the success of a specific cure in the treatment of true gummas.

The next chapter deals with "Diagnosis" in regard to (a) history and common symptoms, (b) physical findings, (c) sputum findings ("There is no specific sputum for syphilis"), (d) serological reactions for syphilis, (e) other syphilitic changes, and (f) roentgen findings—three types (1) the chronic interstitial pneumonic form, (2) the rare isolated gummas, and (3) the miliary gummatous form. The conclusions from reviewing these phases of the situation are that the previously mentioned points are the only decisive ones for diagnosis although the roentgenogram is a necessary adjunct in all doubtful cases and as a means of following the progress of therapy.

The third main chapter heading is "Prognosis and Therapy." The authors say that they will speak in this article less of prognosis and therapy and more of symptoms and diagnosis. They advocate mild and harmless treatment which may be gradually fortified and increased. Their reason for this is the great possibility of a mistaken diagnosis, and

main point of their thesis—the necessity for short exposure technic—was established routinely in this country long since, and it is no longer mentioned. As for the various types of apparatus described, all of them are of purely local German manufacture, and none of them offers any noteworthy features for the roentgen laboratory which is provided with any standard American equipment.

The only real departure in the book is the use of the anaglyphic principle in pulmonary stereoroentgenography, and it is doubtful whether the value of the process the authors advocate is substantiated by the argument or the examples they show. The style is abstruse and complicated, and the article is not graced in its execution with any factors which would predispose the reader in favor of the procedure which the writers promulgate.

W WALTER WASSON, M D

ROENTGEN DIAGNOSIS OF THE VISCERA BY TABLES AND DRAWINGS (RÖNTGENDIAGNOSTIK DER ERKRANKUNGEN INNERER ORGANE IN TABellen UND SKIZZEN) By DR. EMMERICH MARKOVITS, Head of the Roentgen Laboratory of the State Asylum in Budapest, and collaborator of the Central Roentgen Institute of Allgemeines Krankenhaus in Vienna. With an Introduction by the late Hofrat Prof Dr GUIDO HOLZKNECHT, Director of the Central Roentgen Institute of the Allgemeines Krankenhaus, Vienna. Second, revised edition, with 429 illustrations, and 224 pages. Published by Georg Thieme, Leipzig, 1931. Price, 17.50 marks.

This new edition of Markovits' work has included the findings of intravenous pyelography, the methods of bringing out the relief of the gastric and intestinal mucosa, discussion on polyposis, diverticula, and new material on cholecystography and hysteroscopy.

The peculiar value of this work lies in the numerous tables of differential diagnostic points in regard to nearly every lesion of the respiratory, gastro-intestinal, biliary, urinary, and genital tracts. The numerous line drawings illustrate the various diagnostic points

better, perhaps, than the more expensive half-tone reproductions of roentgenograms. These drawings are such as one might make on the blackboard to illustrate class lectures. This method of drawings and comparative tables permits one to cover the entire field of roentgenologic diagnostics of internal medicine within the covers of a relatively small volume. Familiarity with this work cannot fail to enhance very greatly the percentage of correct diagnoses in any roentgen laboratory. All radiologists, readers of German, will do well to acquire a copy of this valuable treatise.

JAMES T CASE, M D

ROENTGEN DIAGNOSIS AND THERAPY IN DISEASES OF THE EYE (DIE RÖNTGENDIAGNOSTIK UND -THERAPIE IN DER AUGENHEILKUNDE) Radiologische Praktika, Band 19. By DR. WOLFGANG HOFFMANN, Chief Physician of the Ophthalmological Clinic, University of Königsberg; 1 Pr. Pages, 72, and illustrations, 20. Published by Georg Thieme, Leipzig, 1932. Price, 8.70 marks.

This is a small but very timely volume, for, in addition to the 24 pages devoted to roentgen diagnosis in diseases of the eye, the remainder of the 72 pages in this work is devoted to roentgen therapy, beginning with damage which may be suffered from the roentgen rays. These roentgen-ray damages to the eye are considered under two headings. First, those which may appear shortly after the irradiation, second, late-appearing damage, such as cataracts and glaucoma. There follows an appropriate chapter on protection of the eye during roentgen irradiation, and then a detailed consideration of the application of X-rays in the treatment of tuberculosis of the eyes and their surroundings, chronic inflammation of the eyeball other than tuberculosis, chronic inflammation of the lids, especially blepharitis, granulosis, and spring catarrh, acute inflammation, glaucoma and epiphora tumors. Ten pages are devoted to the literature.

Of special interest, and as a timely warning there is an excellent section devoted to cataracts and glaucoma as late roentgen damages.

ABSTRACTS OF CURRENT LITERATURE

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THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

J N Ane, M D
Henry Bayon, M D
Samuel Brown, M D
L J Carter, M D
F Cavers, D Sc.
Donald S Childs, M D
Murry M Copeland, M D
Boni J DeLaureal, M D
Charles H DeWitt, M D
C E Dukes, M D, M Sc.
Nathan Flax, M D
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Hans W Hefke, M D
Hans A Jarre, M D

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Francis B Sheldon, M D
C G Sutherland, M D (Tor)
Jacob H Vastine, M D
W W Watkins, M D
William W Whitelock, Ph D

the consequent ill effects which would accrue to a diseased heart condition if strenuous anti-syphilitic treatment were instituted at the beginning of the illness.

The fourth chapter deals with the "Pathological Anatomy." Dr Dünner, Dr Leeser, and Dr Blume distinguish two types (1) the interstitial pneumonic form, and (2) the gummatous. According to localization, they list three groups:

1. Gummatous changes with coarse radiating cicatrices, in the upper and lower lobes.

2. The interstitial form with finer cicatrices in the hilus region.

(a) In the lower lobes.

(b) Especially probable in the right middle and lower lobes.

3. Bronchiectasis on a syphilitic base, in the middle and lower lobes.

Also, they have compiled an excellent diagrammatic chart which portrays, in graphic and readily accessible form, the similar and dissimilar characteristic findings of pulmonary syphilis and tuberculosis.

After citing twelve cases, of which four were positive syphilis, four were probable syphilis, three were doubtful, and one was tuberculosis with a questionable syphilitic complication, the authors conclude with certain questions prompted by the critical analysis of these cases. They do not attempt to answer the questions, and the reader is left with the impression that they believe:

(1) That pulmonary syphilis *per se* is truly a rare disease.

(2) That the diagnostic methods at our disposal are valuable but not conclusive, because of the similarity between the case history, common symptoms, physical findings,

sputum examination, and serological reaction for syphilis and other chronic pulmonary diseases.

(3) That there are but two factors which can be considered positive indicators of lung syphilis—(a) failure to demonstrate tubercle bacilli in repeated sputum examinations, (b) the localization of the process in the middle and lower lobes, especially of the right lung.

(4) That there is a third point which may be considered as confirmatory in the diagnosis of pulmonary syphilis, namely, the success of a specific cure in the treatment of true gummas.

(5) That even the careful consideration of the collected clinical and recorded findings and tests can lead only to a presumptive diagnosis.

(6) That the positive diagnosis must come from the examination of necropsy material by a pathologist experienced in discerning this particular disease.

(7) That tuberculosis and syphilis may exist simultaneously in different sections of the same pair of lungs.

On the whole, the authors seem to be constantly advising the utmost care and precision in the analysis and evaluation of diagnostic and therapeutic measures as well as persistent skepticism even in the face of what may seem to be an absolutely positive diagnosis of pulmonary syphilis. The style is direct and straightforward, and there is no equivocation in the statements of their opinions. The especially facile German in which it is written makes the original publication pleasant and enlightening to even the American reader possessed of but a textbook knowledge of the language.

W WALTER WASSON, M.D.

of the expanded tendons, soon becomes the site of a fibrosis. When the condition progresses so far that there is an exudate within the joint this gravitates to the anterior-inferior aspects of the capsule, where it becomes organized and forms adhesions. Unless these adhesions are broken up it is futile to spend time and money on physiotherapy.

Where arthritis exists, it is rational to consider the process infective, and to do a reasonable removal of foci. Later, when the joint is quiescent and showing some increased range of motion, adhesions may be broken up. Where tipping about the joint margins is excessive or the degeneration of osteo-arthritis is present, only fixation in a favorable angle can be accomplished.

L J CARTER, M.D.

Roentgenotherapy of Chronic Arthritis H O Röhr Strahlentherapie, Oct 24, 1931, XLII, 425-436

The author first discusses briefly the literature on roentgenotherapy in arthritis. He usually applies from 20 to 30 per cent H.E.D. (180 K.V., 0.5 mm Cu + 1 mm Al, 4 ma) at a distance of 30 centimeters. Since it seems advisable to irradiate also the tissue surrounding the joint, large fields of 10 X 15 sq cm are used even for small joints. For large joints two fields are used in order to cover the surrounding tissue. Exposures are given at intervals of from three to four days.

A total of forty patients suffering from chronic arthritis were irradiated. Half of those had primary or secondary chronic arthritis, the other half, arthritis deformans, gout, and septic arthritis. In most cases irradiation was started after all other methods of treatment had failed. The most striking feature was a relief from pain following the first exposure. Swelling decreased and motility was improved. Then follows a brief discussion of the possible mechanism of the effect of roentgenotherapy in arthritis.

ERNST A POHLE, M.D., Ph.D.

THE BLADDER

Reticulolymphosarcoma of Bladder R. Dupont and V. Mistachi Presse Méd., June 24, 1931, XXXIX, 937, 938 (Reprinted from "Cancer Review" by permission.)

In a woman, 32 years of age, who complained of repeated hematuria, pain in the right lower quadrant, and loss of weight, vaginal palpation revealed a right paramedial induration, the urine drawn off containing blood and pus. At operation a bi-lobed infiltrating tumor was found occupying a large part of the right lateral wall of the bladder. This was

removed successfully by partial cystectomy. The recovery was uneventful, the patient being in good health a year later.

Lerou diagnosed the tumor histologically as a lymphosarcoma in which the stroma consisted of reticular cells. The authors add that since these sarcomas are radiosensitive, they would have used deep X-ray therapy, had it been possible to make a histologic diagnosis first, and that this will be resorted to should there be recurrence.

F CAVERS, D.Sc.

The Roentgen Ray and Radium in the Diagnosis and Treatment of Carcinoma of the Bladder G. E Pfahler Surg, Gynec and Obst., November, 1931, LIII, 680-690

The author believes additional information is obtained by combining a pneumocystographic study with the cystoscopic examination. In carcinoma of the bladder it is valuable in demonstrating the size, position, outline, and degree of infiltration.

The technic for pneumocystograms is to make an anterior and a posterior film of the bladder region before any air is injected. Any opaque calculus present will be shown, also any localized collection of gas in the rectum or colon which may hinder the interpretation of the subsequent pneumocystograms. Any residual urine should be withdrawn—the usual sterile methods being used—for a soft tumor surrounded by fluid may not be demonstrated. Either the film made anteriorly or posteriorly will show the tumor surrounded by air, even though occasionally one is unsuccessful in removing all the urine.

After the urine has been withdrawn, an atomizer bulb is attached to the catheter by using a tapering glass connecting rod, then by gentle compression with the thumb and index finger, air is pumped into the bladder until the patient complains of bladder distention or until one can feel the distention of the bladder by palpation or outline it by percussion. The catheter is then clamped with hemostatic forceps and both are strapped to the thigh with adhesive plaster. All of these procedures are performed as quickly as possible, with the patient on the Bucky diaphragm, and the tube and film in position, thus minimizing the delay and distress from bladder distention. If the injections are made slowly and due attention is paid to the patient's complaint of pressure, no harm results.

One or more 8 X 10 films are made posteriorly, directing the rays in line with the axis of the pelvis. Then one or more films are made anteriorly, the patient being carefully turned upon the abdomen and the rays directed obliquely, anteriorly, and upward. There should be some variation in the exposures. With the patient again in the supine position, the clamp is released and the air is quickly

THE APPENDIX

The Active Motility and the Emptying Mechanism of the Appendix Vermiformis Ernst Schmidlein Fortschr a. d. Geb. d. Rontgenstr., August, 1931, XLIV, 141-162

Observations on 21 appendices were made, from 7 to 9 hours *p.c.*, some under the influence of saline cathartics, all under the pharmacologic influences of 0.01 mg pilocarpin, and 1 or 2 mg of atropin at intervals of from 20 to 40 minutes. Conclusions were chiefly drawn from a comparison of from 4 to 8 exposures made at irregular intervals and some from occasional fluoroscopy. Experiments covered not more than 40 minutes. The author is aware of the possibility that the visible appendiceal shadow may not represent the entire length of the organ.

(*Abstractors Note*)—It seems that the time of observation is much too short and that terms like "spasm at the appendico-cecal junction" should better be replaced by "contraction", "stagnation" in the terminal portion also is easily misleading as it might give the impression of a pathologic phenomenon, the German term "Beutelung" ("pocketing" in English) might be less conspicuous.)

Motility of the organ is chiefly the result of changes in tone of the muscle coats. The proximal portion shows the expressions of changes in tone, peristalsis (at times reversed), and contractions. The distal portion is motorically inert and pockets contents regularly. Changes in muscle tone produce elongation and shortening, with apparent segmentation. Tortuosity and stagnation are of no functional pathognomonic significance.

HANS A. JARRE, M.D.

ARTHRITIS

Traumatic Disability of the Shoulder George A. Ramsay Canadian Med. Assn. Jour., November, 1931, XXV, 566-571

Shoulder function may be seriously disabled by the common traumas of accident or by occupational over-use. That such cases need careful attention is seen in the records of insurance companies and workmen's compensation boards where shoulder injuries are found to account for an average period of disability greater than other traumas. In one large group of cases of shoulder disability not due to fracture, one-eighth recovered fully in three months, while nearly one-half had partial permanent disability and another eighth had permanent incapacity. The contribution of the X-ray examination was to the effect that one-half had no evident bone lesions, and that in cases in which such did exist

they were found more frequently in the acromio-clavicular joint than elsewhere. When osteoarthritis occurs in the shoulder following injury it is prone to become progressive, more so than in any other joint. If our previous concepts of management are insufficient, then we must face a situation that warrants our best efforts to arrive at a better rationale in treatment.

Shoulder disabilities would seem to fall within certain groups (1) Frank trauma, with subsequent limitation of function, (*a*) burns causing a skin cicatrix, (*b*) fractures and dislocations (2) Unseen traumas, with latent disability, (*a*) tendonitis, (*b*) neuritis, (*c*) cartilage injury, including recurrent dislocation, (*d*) adhesions, (*e*) periarthritis and arthritis.

Evident bone injury most frequently involves the upper third of the humerus, i.e., the surgical and the anatomical neck, the tuberosities, and especially the facet of the supraspinatus on the greater tuberosity. In these conditions we should avoid such fixative appliances as will keep the arm applied to the body in the abducted internal rotated position. Further, the shoulder should not be neglected in the treatment of fractures of the clavicle, the lower humerus, the elbow, or the forearm. No splint should be applied in such a way as to cause a drag on the shoulder girdle. It should be remembered that the shoulder joint, with its shallow socket and large humeral head, is held in place largely by muscular action, the capsule playing a minor role in this respect. Any position or type of fixation that places any continued strain on these muscular supports will cause future loss of function and produce future discomfort.

Special attention is drawn to the avulsion of the facet of attachment of the supraspinatus muscle on the greater tuberosity, or to the rupture of the tendon of the muscle itself. So-called sprains of the shoulder joint are not due to a rupture of the capsule as in many other joints, for the capsule of the shoulder is so lax that it is almost impossible to rupture it. The injury is most often that to the supraspinatus muscle described above. The author gives detailed technic for the elicitation of this injury.

By far the larger group of cases of shoulder disability are those in which a definite anatomical lesion is not determinable, and in which the terms, synovitis, periarthritis, strain, or bursitis are very loosely applied. In general, we may say that there are injuries to the soft parts, with coincident synovitis, the acute lesion being usually sprain of muscle or tendon while the more chronic lesion may be termed a periarthritis.

Muscle strain results in the formation of exudates, with subsequent adhesions about the tendinous extremity of that muscle. As this progresses it involves the capsule. The capsule, being the fusion

author denies that true osteochondritic processes (Perthes) is a cause of such deformities, but admits that such disease may occur occasionally without relation to the former dislocation He assumes, furthermore, that some of Freund's deformities may be explained by incongruities between the acetabula and the femoral heads, necessitating structural transformations A reply from Freund is added to this paper, in which he maintains his stand

HANS A JARRE, M D

The Roentgenologic Diagnosis of Bone Tumors
Franz Polgar Rontgenpraxis, Nov 1, 1931, III,
963-972

The roentgenologic examination of bone tumors, especially if done in serials, is more important than even a biopsy The removal of a small piece of tissue from bone tumors is not always harmless, and histologic examination of such small specimens does not always decide between the benign or malignant type The differentiation of these two on roentgenograms is often possible only if a series of films, taken at intervals, is studied.

Benign tumors are most often centrally located They do not infiltrate the surrounding bone, but may grow expansively The structure of the surrounding bone in benign lesions is more uniform, and the outline of the tumor is more definite The malignant tumors raise the periosteum, are not definitely circumscribed, and lead to dense ossification of the bone or soft tissues Rather frequently the benign giant-cell tumor is mistaken for a sarcoma, and sometimes a solitary osteolytic bone metastasis has been believed to be a sarcoma.

The osteogenic sarcoma is the most malignant and the most frequent bone tumor Ray-like arrangement of periosteal bone proliferation is the most dependable roentgen sign, elevation of the periosteum being important, also Occasionally a diagnosis cannot be made roentgenologically, especially if the case be early In 72 per cent, the lower extremities are attacked, the age is usually found to be in the second decennium Pain, especially at night, is clinically a very early symptom The prognosis is poor In Ewing's statistics only 6 per cent remained alive after five years Early amputation with pre- or post-operative irradiation seems advisable, roentgenotherapy alone offering only palliation

The extrperiosteal fibrosarcoma is a rare tumor, which shows in a roentgenogram only a soft tissue tumor, sometimes with erosion of the neighboring bone The prognosis after surgery is better than in an osteogenic sarcoma Irradiation has no effect

The "Ewing Sarcoma" (endothelial myeloma) represents about 10 per cent of all bone tumors and is found in young individuals The diaphysis of long

bones is often involved, especially the fibula and tibia, sometimes it is found in the small bones of the extremities or in the skull and vertebrae This tumor is the only type which metastasizes to other bones The roentgenogram shows frequently an onion-like layer periosteal bone growth, often with areas of destruction in the bone A soft-tissue tumor may often be seen This tumor is very radiosensitive. The prognosis for a permanent cure is poor, as most cases are diagnosed in a late stage

The multiple myeloma is typified by multiple, small, round, circumscribed areas of bone destruction New bone formation is absent A diffuse osteoporosis accompanies the picture in many cases Skull, ribs, pelvis, and long bones are attacked Lung metastases are not found, contrary to the case of other sarcomas

The benign giant-cell tumor (or osteogranuloma) is the most frequently occurring benign tumor It probably represents an overproduction of granulomatous tissue, occurring after a medullary hematoma or another trauma It must not be mistaken for an osteitis fibrosa cystica The roentgenologic film is very characteristic, and difficult only in flat bones The tumor is usually centrally located and expands the surrounding bone symmetrically, cystic areas of different size may be present In advanced cases the tumor breaks through the bone into the soft tissues Usually a few thin bone trabeculae remain visible in the tumor A periosteal bone-growth is absent The prognosis is always favorable Bloodgood could not find in his review a single occurrence of sarcomatous degeneration Surgical curettage is followed by recurrence in from 20 to 30 per cent of the cases Roentgenotherapy is the treatment of choice, as recurrences have not been reported The tumor shows a definite increase in size after the treatment and begins to decrease only after about two months Complete ossification can be looked for in about one year Many cases of this benign tumor have been operated on with the diagnosis of a sarcoma and many bones have been needlessly amputated

Chondromas and osteomas are considered congenital anomalies rather than tumors Chondromas grow expansively and often show typical calcification They are always bounded by a sharp line

Metastatic bone tumors are diagnosed by their multiplicity, their characteristic localization, and by the knowledge of a primary tumor The hypernephroma and carcinoma of the thyroid may cause solitary metastasis

Hodgkin's disease, lymphosarcomatosis, actinomycosis, and the echinococcus disease may simulate malignant tumors, when they attack bones

H W HEFKE, M D

Osteogenic Sarcoma Developing in Osteitis Deformans (Paget's Disease of the Bone) A. Ochsner

expelled compression may be used to aid in removing all of the air. The author has made several hundred such examinations with no damaging effects.

IRRADIATION TREATMENT

The author is not satisfied with the results of either surgical excision or irradiation, but points out that irradiation is used almost entirely in "inoperable" cases. He gives most complete tables showing the various methods of radiotherapy. Radium may be used alone in the form of capsules, needles, or seeds (glass or gold), or deep roentgenotherapy may be used alone, also in conjunction with electrocoagulation, before or after. The method of suprapubic cystotomy, electrocoagulation, and radium needles has been abandoned by the author, but that of electrocoagulation followed by highly filtered radium capsules packed into the bladder against the base of the tumor is favored.

Tables are also given of combined surgery and radiation treatment, electrocoagulation and radiation therapy, and of irradiation only.

D S CHILDS, M D

BONE (THERAPY)

Technic of Treatment of Fracture Re-dressing without Removal of Plaster of Paris Bandage. Mauritz Parsson. *Acta Orthopedica Scandinavica*, 1931, 166-201

In treatment of fractures of the long bones, a *dislocatio ad arum* not infrequently occurs, either immediately after application of the plaster of Paris bandage or a few weeks later. In such cases, instead of removal of the bandage, with re-dressing and application of a fresh bandage, the author advocates the following procedure. After roentgen examination in two perpendicular planes, generally the frontal and sagittal, the following measures are taken:

(1) Measurement on the roentgenograms of the angle between the axis of the lower fragment and the prolongation of the axis of the upper fragment (here termed the "angle of deviation")

(2) A horizontal cut is made by saw in the bandage at the level of the fracture, through the entire bandage, with preservation of a bridge from 4 to 5 cm broad, on the side toward which the vertex of the angle between the fragments seems to point.

(3) Breaking of the plaster of Paris bandage with the enclosed member until the cut made by the saw is open at the desired angle, and then insertion into the cut of a plug of suitable size and shape.

(4) Roentgen control

(5) Stiffening of the bandage with starch and plaster of Paris dressings.

In the fourteen cases recorded by the author the desired end was achieved and the angle of deviation was done away with, or nearly so. Five cases are reported in detail, with roentgenograms taken before and after the interference.

Further, a method, with figures and formulae, is explained which renders it possible, exclusively by means of the two angles of deviation ascertained by roentgenograms in two perpendicular planes, to determine mathematically both the angle of deviation proper and the plane in which the angle of deviation lies in relation to the frontal and sagittal planes of the patient.

W W WHITELOCK, Ph D

BONE DISEASES (DIAGNOSIS)

A Clinical and Radiologic Study of a Case of Dyschondroplasia. Giorgina Giacomini. Riv di radiol e fisica med., December, 1931, IV, 206-222.

This case illustrates the following important radiologic points. Dyschondroplastic changes may be symmetrical and extend throughout most of the cartilaginous bones; in addition, there may exist cartilaginous exostoses and chondromatous outgrowths; these chondromatous changes may be encountered not only in the skeleton but also in any organ containing cartilage.

The case report has several excellent radiographs and is supplemented by an extensive bibliography.

E. T. LENNY, M D

Deformities of the Femoral Head Following Non-surgical Reduction of Congenital Dislocations of the Hip. Max Lange. Fortschr a. d. Geb d. Röntgenstr., August, 1931, XLIV, 227-231.

This paper is a reply to a publication by Freund, abstracted in a previous issue. The author contends that "late deformities of such hips are seen the more frequent the larger number of former old congenital hip luxations." Such late deformities never occur in femoral heads which originally were well formed and developed normally. Consequently, there is no danger of late deformities in cases in which an anatomic, perfect cure is obtained with reduction (concluded from study of cases from Munich, Dresden, Zwickau), covering a 10 to 15 year period.

One must differentiate between early and late deformities of such femoral heads, the former developing during the first year following the reduction, the latter occurring independently years later. Early deformities continue to undergo changes for many years, as these joints of lessened functional capacity will not tolerate normal use. They not infrequently terminate with arthritis deformans. The

publication of Kienbock and Preiser, concerning malacia of the os naviculare and lunatum, and has aroused wide interest. Three cases are reported, which could be observed during several years. They showed at the onset, as outstanding roentgenologic signs, small isolated cavities in the carpal bones. Two of these could be considered definitely tuberculous, as the patients had other bone or joint pathology which followed a clinical and roentgenologic course, compatible with the assumption of such infection. The third patient was considered tuberculous as no other possible explanation could be detected, and the lesion showed regenerative changes in the time of observation and during X-ray treatment.

The difficulty in differentiation between Kienbock-Preiser's malacia, localized osteitis fibrosa (Konjetzny-Kappis), structural anomalies, projective simulation of disease, osteomyelitis, and enchondroma is stressed, and the remarks concerning malacia are of interest.

HANS A JARRE, M D

Periosteal Thickening in Paget's Disease as Well as in Recklinghausen's Disease H Meyer-Borstel Röntgenpraxis, Sept 15, 1931, III, 830-833

The absence of periosteal proliferation is one of the diagnostic signs of generalized osteitis fibrosa (Recklinghausen) in Schmorl's opinion, while a Paget's disease shows the presence of it. The author shows in two cases the presence of well-defined periosteal thickening and proliferation. Generally Recklinghausen's disease does not give evidence of it, but in chronic cases (as in the one shown by the author) it may be definitely present.

H W HEFKE, M D

BONE DISEASES (THERAPY)

Solitary Cysts of the Long Bones F Jacoby Arch f Klin Chir, 1931, CLXIII, 386-406 (Reprinted from "Cancer Review" by permission)

The author describes ten cases, seen during the past three years, of single long-bone cysts, excluding parasitic cysts and those arising in malignant tumors and thus dealing only with localized cystic osteitis fibrosa, cystic benign tumors (fibromas, chondromas, giant-called brown tumors) and cysts of undetermined origin. Of the ten patients, eight were from 3 to 16 years of age, the others 25 and 40, respectively. In seven there was pathologic fracture.

Curettage of the cyst cavity is the treatment of choice, with suitable splints the fractures healed well, and in all cases (except one lost sight of) normal function of the extremity followed operation.

The author emphasizes the need for biopsy since X-ray examination does not suffice to distinguish among a cyst, chondroma, fibroma, osteitis fibrosa, brown tumor, and malignant central sarcoma.

The author does not think that trauma often plays a primary part in the etiology of bone cysts, though it may secondarily affect an already cystic bone by causing fracture or setting up infection. In his ten cases, there was primary trauma in one case and secondary trauma in four.

F CAVERS, D Sc.

Osteosarcoma of the Femur Treated by Radiotherapy M Delaye Lyon Chir, May-June, 1931, XXVIII, 338, 339 (Reprinted from "Cancer Review" by permission)

A 24 year-old soldier had been complaining for four weeks of swelling at the lower end of his left thigh. A radiograph showed a typical osteogenic sarcoma, with marked destruction of the cortex. A large skin incision was made and the tumor freely exposed. Deep X-rays were then delivered directly to the growth, a total dose of 6,000 r without a filter being given in one sitting. The tumor now shows considerable reduction in size. A further report of this case will be of considerable interest as the radiation technic employed is entirely new.

P J KERLEY, M B

CANCER (DIAGNOSIS)

Studies on the Blood of Persons with Carcinoma G Creuzberg, F Dannmeyer, O Hartleb, E L Lederer, L v Noël, J Schubert, H Seel, and L Treplin Strahlentherapie, Nov 14, 1931, XLII, 609-709

This paper deals with studies of the cancer problem carried out by a group of physicians, physicists, chemists, and biologists. Their co-operative plan comprises the following problems: Physicobiologic considerations of the cancer problem, chemical studies on the serum of patients with carcinoma (the "cancer index" and other characteristic factors regarding the cancer diagnosis), spectrometric studies on the blood serum of patients with carcinoma (the "cancer curve"), colloid chemical studies on the serum of man, particularly cases with carcinoma (the "protective index"), animal experiments, and last, clinical remarks concerning the blood studies on patients with carcinoma.

It is utterly impossible to attempt in an abstract to do justice to the tremendous material collected by the authors. Suffice it to say that very definite relations between fatty acids, cholesterol, and acidity of the blood in the serum of healthy persons and

and I M Gage. Surg Clin N America, August, 1930, X, 851-868 (Reprinted from "Cancer Review" by permission)

The authors found in the available literature thirty-one cases of Paget's sarcoma or osteogenic sarcoma arising on osteitis deformans, every one of the patients died within a short time after the appearance of malignancy.

They describe a case occurring in a man, 61 years of age, with a history suggesting Paget's disease of the right tibia and the skull for about ten years. A year before admission to the hospital he fell and hurt the right knee, and after this noticed gradual swelling and increasingly severe pain. X-ray examination revealed typical Paget's disease in both femora, tibiae, and ilia and in the skull. In the right tibia there coexisted with this a periosteal sarcoma invading the muscles. The limb was amputated, but death occurred seven weeks after operation. At necropsy there were found metastases to lungs, liver, and mesenteric and mediastinal lymph glands. Despite the very bad prognosis of sarcoma superposed on Paget's disease, the authors regard amputation as justifiable in order to relieve the severe pain.

F CAVERS D Sc.

Osteochondromatosis of the Joints R. Kienböck.
Rontgenpraxis, Oct 1, 1931, III, 895-899

Osteochondromatosis is a tumor disease of the joints, in which osteomas as well as chondromas are present. There are different types of this disease some with multiple osteomas and one or several chondromas, and another type with a single exostosis and multiple cartilaginous bodies. The author describes some cases.

H W HEFKE, MD

Osteochondromatosis of the Knee Joint Paul C Colonna Surg, Gynec and Obst., November, 1931, LIII, 698-703

This rare pathologic process is seen most often in early or middle adult life, though no age-period is exempt. Pedunculated and loose cartilaginous bodies are formed from the synovial membrane of joints, the knee being most commonly affected. These bodies are thought to represent an overstimulation of a normal process and to begin to grow from the outer fibrous layer of the joint capsule and push their way toward the joint cavity. They grow to different sizes before being cast free into the joint. (The type of injury is the probable deciding factor in the portion of the joint first involved.) The exact cause has not been proved, but a review of many cases gave a history of trauma to the joint, either direct or from irritation produced

by wrenching or twisting. Occasional sharp pain followed as well as increased limitation of movement or a feeling of weakness about the joint.

There are at least two types of osteochondromatosis (1) Those cases in which one or more, usually multiple, loose bodies are free within the joint. These may be of varying sizes—large ones are sometimes three-fourths of an inch in diameter—oblong or round with glistening white, cartilaginous surfaces, often pitted and presenting numerous bosses. Their tendency is to wander about though they often gravitate backward during movement and produce few symptoms. The absence of any area of calcification is noted. (2) The bodies in great quantities were found both free and attached. This type more nearly resembles a neoplastic process, and the earlier cases pass unnoticed on the roentgenogram. In one case reported the whole interior of the joint appeared studded with literally thousands of small, glistening, pearly white bodies about the size of seed pearls. Many of these bodies were attached to the synovial membrane by tiny stalks, others were free within the joint, and many had fused together, this being the only case with a distinctly rancid odor.

In the fourth case report given by the author, the only symptoms present were those caused by mechanical blocking, there being no increase in the joint fluid or local heat or redness. The roentgenogram is regarded as the deciding factor in diagnosis. The treatment is surgical.

D S CHILDS, MD

Joint Osteochondromatosis, with Formation of a Sarcoma. Heinrich Reimann and Robert Kienböck. Röntgenpraxis, Oct 15, 1931, III, 942-944

Osteomatosis, chondromatosis, and osteochondromatosis of joints are in general benign affections and do not develop malignant changes. That a sarcoma may rarely develop on the basis of these changes is shown by a case, described in detail. Roentgenologic examination of the right knee showed an osteochondromatosis of the usual type, with chondromatous and osteomatous growths, beside it there was a large tumor with irregular, cloudy areas of calcification. The inguinal glands were enlarged. After amputation the pathologic diagnosis was osteochondroma with sarcomatous changes.

H W HEFKE, MD

Tuberculous Etiology of Roentgenologically Demonstrable Cavities in the Carpal Bones Hans Hanke Fortschr a d Geb d Röntgenstr., August, 1931, XLIV, 188-197

This paper contributes to the discussion on lesions of the carpal bones in adults which began with the

showed displacement of the esophagus to the right and deformation of the duodenal bulb, suggesting the presence of a tumor lying behind the stomach and compressing the duodenum. Neither in the liver nor other part of the abdomen was there evidence of echinococcus cysts. Exploratory laparotomy showed that a tumor was present above the left half of the diaphragm, and later an attempt was made by rib resection to remove this tumor, which proved to be a large, grey, fleshy inoperable mass found on microscopic examination to be a pulmonary carcinoma. The patient died soon after the second operation, and necropsy showed the right lung to be almost entirely replaced by a fetid, necrotic, carcinomatous mass.

F CAVERS, D Sc

Cancer Diagnosis by Spectro-photometry Editorial, British Med Jour, Aug 1, 1931, No 3682, p 196

Bendien, of Zeist, Holland, claims to have elaborated a laboratory method for diagnosis of carcinoma by blood examination. The technic consists of two parts.

The first is a flocculation method in which the serum is precipitated with various mixtures of acetic acid and sodium vanadate, this precipitate is dissolved in 2 per cent sodium bicarbonate solution, which is submitted to spectro-photometric examination. From a series of spectrograms the extinction coefficients are obtained, and it is on the basis of the curve so plotted that the diagnosis is made. Bendien's view is that cancer is a local disease which can develop only if a specific abnormality of the serum is present. He is not satisfied yet that he can obtain an accurate diagnosis in every case of carcinoma, but he claims that a positive reaction is never seen in cases of any other disease. A matter of very considerable interest is the fact that Bendien has been unable to discover any specific characters in the serum of cases of sarcoma.

WALLACE D MACKENZIE, M D

Is Cancer an Infectious Disease? C Sternberg Wien. klin. Wochenschr., Jan 23, 1931, XLIV, 97-99 (Reprinted from "Cancer Review" by permission.)

The author has published many excellent reviews on special aspects of malignant disease, and now adds another in which he deals in a trenchant manner with some recent publications in which some infective agent or other has been proclaimed to be the real *causa causans* of cancer.

He begins by recalling the fact that in the early days of bacteriology living agents were sought as the cause of malignant growths, and also that at

that time no clear distinction was drawn between infective granulomas and neoplasms—the difficulty in making such a distinction was pointed out by Virchow in his book on tumors, published about seventy years ago. From these early days down to the present time numerous bacteria, fungi, yeasts, protozoa, etc., found in tumors have been regarded as oncogenic agents, though it has been proved that many of these bacteria, etc., may be found in any tissue and that various saprophytic forms may be easily isolated from a tumor.

The author next gives more definite instances. He considers that Gye's work has been completely refuted. Most of Heidenhain's mouse tumors were obviously spontaneous growths bearing no relation to the injection of human tumor autolysates into the animals. Sternberg agrees in this with Hellner and says the experiments have been repeated in his own laboratory on 400 mice with absolutely negative results. As to Blumenthal's claim to have produced animal tumors with *Bacterium tumefaciens*, he points out that this writer now claims that this organism only sets up inflammation of a precancerous nature, from which a neoplasm may arise, but as other writers have not been able to produce tumors in this way the connection of *Bacterium tumefaciens* with animal tumors may be abandoned. The author does not believe that the Rous sarcoma itself affords any evidence for the parasitic theory of tumors. The Rous sarcoma differs too much from all other known forms of tumor for any results obtained from its study to be applied to the etiology of tumors in general.

The author's general conclusions are summarized in the following sentence: "Parasites, in the widest sense of the term, have no other rôle in the causation of malignant tumors than have injuries due to a great variety of agents of chemical and physical nature, hence it may be asserted definitely that there is no specific cancer agent and that cancer is not an infectious disease."

F CAVERS, D Sc

Cancer in Young Persons E Wildbolz Ztschr f Krebsforsch, 1931, XXXIII, 681-708 (Reprinted from "Cancer Review" by permission.)

From an analysis of the pathologic material examined in the Institute [Pathological Institute, University, Bern] from 1920 to 1929, which includes autopsies and tumors removed by operation, it is found that of 5,536 cases, 94 referred to patients under 30 years of age. Of these 94 patients, four were children. This gives a percentage of 1.79 of all malignant growths which had been examined and represents a slight diminution when compared with the period from 1906 to 1915. No evidence could be obtained from the clinical history that cancer in young persons is particularly malignant. In a few

those with carcinoma were established. This led to the creation of the "cancer index." A typical "cancer curve" was seen in the absorption studies if the wave length was plotted against the absorption coefficient of the alcohol-ether extract of the blood serum, prepared according to Noël. A colloid chemical test is also described which offers encouraging possibilities in the sero-diagnosis of carcinoma. These particular studies led to the creation of the so-called "protective index."

Animal experiments concerning the inhibiting effect of blood extracts from patients with and without carcinoma did not show definite results. A few practical remarks of the medical co-worker conclude the article. It is recommended for careful study in the original to all radiologists interested in the cancer problem.

ERNST A. POHLE, M.D., Ph.D.

Carcinomatous Degeneration of Polyp of the Stomach. Report of Eight Personal Cases with Review of Twenty-four Recorded by Others T. G. Miller, E. L. Elsason, and V. W. M. Wright. Arch. Int. Med., November, 1930, XLVI, 841-878. (Reprinted from "Cancer Review" by permission.)

Besides reviewing twenty-four cases found in the available literature, the authors describe eight cases of their own occurring in a series of 200 operations for cancer of the stomach. They conclude that carcinomatous polypi usually arise in benign adenomatous polypi. Quoting from the authors, "most of the patients showing such malignant change are males (80 per cent), and the age incidence is the same as for mural gastric cancer (83 per cent over 40 years of age). The symptoms are those of any malignant gastric lesion with, in addition, those of the two other common consequences of gastric polypi—intermittent pyloric constriction and hemorrhage. The hemorrhage may be frank or occult, it not infrequently leads to an erroneous diagnosis of primary anemia (three of our eight personal cases). Consequently, gastric polypi should be considered in all cases of unexplained anemia. Roentgenologic study alone often makes the diagnosis of gastric polyp, and malignancy may be suspected on the basis of the clinical picture."

F. CAVERS, D.Sc.

The X-ray Diagnosis of Carcinomatous Metastases in the Lungs. M. Bagliani. Radiol. Med., February, 1931, XVIII, 214-245. (Reprinted from "Cancer Review" by permission.)

The value of radiography for the diagnosis of unsuspected pulmonary metastases is shown by a description of twelve cases. In the author's clinic carcinoma of the breast and carcinoma of the stomach are the most frequent sources of carcinomatous

metastases in the lungs. There are two well-known forms: a generalized infiltrative form, known as lymphangitis carcinomatosa, and a nodular form in which malignant nodules are distributed throughout the lungs. Lymphangitis carcinomatosa is easily recognizable on a radiograph; it runs a rapid course often with pleural as well as pulmonary involvement and does not react to deep X-ray therapy. The nodular form is more chronic. If secondary to breast carcinoma there is usually only one nodule for some time. In some cases the nodules are bunched together near the lung root and in others the nodules are distributed throughout the lower parts of the lungs. The apices are seldom the seat of malignant nodules. Slight improvement may follow deep X-ray therapy in this form of metastasis. The nodular form may be secondary to sarcoma—in such a case the nodules react promptly to X-radiation. The technic for the X-ray examination and the pathology of lung metastases are described in detail.

[It has long been held that, radiologically, metastases to the lungs are not seen in the apices even when there is advanced disease in other parts of the lungs. Improvements in technic and more detailed examination of the apices in such cases disprove this view.]

P. J. KERLEY, M.D.

The Diagnosis of a Primary Carcinoma of the Ureter from the Roentgenogram. H. Sauer. Röntgenpraxis, Oct. 15, 1931, III, 935-937.

The diagnosis of a primary carcinoma of the ureter has been made possible only by pyelograms, either by cystoscopy or by intravenous administration. The latter is often of more help because introduction of a ureteral catheter is frequently impossible. Roentgenograms of such a case are shown. They reveal a filling defect and partial obstruction.

H. W. HEFKE, M.D.

Carcinoma of the Lung of Long Duration. L. H. Ball. Jour. Coll. Surg. Australasia, November, 1930 III, 286-290. (Reprinted from "Cancer Review" by permission.)

A man, 60 years of age, was found, seven years before his death, to have pleural effusion (verified by X-ray examination), and was admitted to a sanatorium on a diagnosis of phthisis. Later he was discharged as fit for light work. In December, 1928, he was admitted to the hospital on a diagnosis of gastric carcinoma with metastases in the liver. X-ray examination showed a dense shadow over the lower two-thirds of the left lung with a thick oval line, which was interpreted as the wall of a calcified *echinococcus cyst*. Barium filling of the stomach

showed displacement of the esophagus to the right and deformation of the duodenal bulb, suggesting the presence of a tumor lying behind the stomach and compressing the duodenum. Neither in the liver nor other part of the abdomen was there evidence of echinococcus cysts. Exploratory laparotomy showed that a tumor was present above the left half of the diaphragm, and later an attempt was made by rib resection to remove this tumor, which proved to be a large, grey, fleshy inoperable mass found on microscopic examination to be a pulmonary carcinoma. The patient died soon after the second operation, and necropsy showed the right lung to be almost entirely replaced by a fetid, necrotic, carcinomatous mass.

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The author has published many excellent reviews on special aspects of malignant disease, and now adds another in which he deals in a trenchant manner with some recent publications in which some infective agent or other has been proclaimed to be the real *causa causans* of cancer.

He begins by recalling the fact that in the early days of bacteriology living agents were sought as the cause of malignant growths, and also that at

that time no clear distinction was drawn between infective granulomas and neoplasms—the difficulty in making such a distinction was pointed out by Virchow in his book on tumors, published about seventy years ago. From these early days down to the present time numerous bacteria, fungi, yeasts, protozoa, etc., found in tumors have been regarded as oncogenic agents, though it has been proved that many of these bacteria, etc., may be found in any tissue and that various saprophytic forms may be easily isolated from a tumor.

The author next gives more definite instances. He considers that Gye's work has been completely refuted. Most of Heidenhain's mouse tumors were obviously spontaneous growths bearing no relation to the injection of human tumor autolysates into the animals. Sternberg agrees in this with Hellner and says the experiments have been repeated in his own laboratory on 400 mice with absolutely negative results. As to Blumenthal's claim to have produced animal tumors with *Bacterium tumefaciens*, he points out that this writer now claims that this organism only sets up inflammation of a precancerous nature, from which a neoplasm may arise, but as other writers have not been able to produce tumors in this way the connection of *Bacterium tumefaciens* with animal tumors may be abandoned. The author does not believe that the Rous sarcoma itself affords any evidence for the parasitic theory of tumors. The Rous sarcoma differs too much from all other known forms of tumor for any results obtained from its study to be applied to the etiology of tumors in general.

The author's general conclusions are summarized in the following sentence: "Parasites, in the widest sense of the term, have no other rôle in the causation of malignant tumors than have injuries due to a great variety of agents of chemical and physical nature, hence it may be asserted definitely that there is no specific cancer agent and that cancer is not an infectious disease."

F CAVERS, D Sc.

Cancer in Young Persons E Wildbolz Ztschr f Krebsforsch, 1931, XXXIII, 681-708 (Reprinted from "Cancer Review" by permission)

From an analysis of the pathologic material examined in the Institute [Pathological Institute, University, Bern] from 1920 to 1929, which includes autopsies and tumors removed by operation, it is found that of 5,536 cases, 94 referred to patients under 30 years of age. Of these 94 patients, four were children. This gives a percentage of 1.79 of all malignant growths which had been examined and represents a slight diminution when compared with the period from 1906 to 1915. No evidence could be obtained from the clinical history that cancer in young persons is particularly malignant. In a few

patients the appearance of cancer was preceded by a trauma. The most striking example is a carcinoma of the lower eyelid which appeared in a young man, 25 years of age, two months after a piece of hot metal filing had accidentally struck the eye.

There is a good bibliography of previous work on the occurrence of cancer in young people.

W CRAMER, Ph D, D Sc

Co-existence of Calcified Retrosternal Goiter and Carcinoma of Esophagus F J Collett and R. Bertrand Lyon Med, Feb 1, 1931, CXLVII, 133-136 (Reprinted from "Cancer Review" by permission)

In a man, 69 years of age, complaining of dysphagia for the last two months, X-ray examination showed at the level of the manubrium sterni a non-homogeneous shadow extending to the aortic arch. The diagnosis was either retrosternal goiter or thyroid carcinoma, and it was decided to make a gastrostomy next day, as the patient had not been able to swallow for five days.

Death occurred during the night. Necropsy revealed a cystic and calcified left thyroid lobe and just below, but free from this, an annular ulcerated tumor of the esophagus, histologically carcinoma, just beginning to perforate into the trachea. The authors add that had esophagoscopy been done during life it would have given the correct diagnosis and supplemented the X-ray findings.

F CAVERS, D Sc.

X-ray Diagnosis of Scirrhous Carcinoma of Stomach L Turano Policlinico (Sez Med), October, 1930, XXXVII, 469-482 (Reprinted from "Cancer Review" by permission)

Six cases are described, and the author emphasizes the difficulty sometimes encountered in distinguishing between scirrhous cancer and syphilis, the X-ray investigation alone being usually insufficient. The case history is important, especially because in syphilis several years elapse before the scirrhous-like condition is reached and during this time the patient has suffered more or less severe gastric pains.

F CAVERS, D Sc

Lupus and Carcinoma A von Mallinckrodt Haupt Dermatol Ztschr, January, 1931, LX, 138-152 (Reprinted from "Cancer Review" by permission)

In this interesting paper the author first cites some statistics regarding the frequency of development of

Carcinoma upon lupus vulgaris. The lowest frequency cited (15 per cent) was given by Sequeira, almost the same (16 per cent) was observed at the Munich clinic (four cases in 249 of lupus), next, 2 per cent at the Wurzburg clinic, and 2.2 per cent at the Freiburg clinic. Higher figures were reported by Darier (4 per cent) and by Stühmer (41 cases in 832, or 5 per cent).

During ten years the author saw 906 patients with lupus, including 28 with lupus carcinoma (3.09 per cent), in all cases on the face. Clinically the majority showed the ulcerated and rapidly growing granuloma-like type of cancer, little influenced by any form of treatment. Roughly, half of the patients had had X-ray treatment, but the author agrees with Albert in believing that X-ray treatment rarely causes lupus carcinoma when it has been given carefully.

F CAVERS, D Sc.

Simultaneous Occurrence of Aortic Aneurysm and Bronchial Carcinoma Carl Mumme. München med Wochenschr, Oct 2, 1931, LXXVIII, 1704, 1705

This is a report of a case of aortic aneurysm which, on the X-ray film, showed an increasing density of the lower lobe of the left lung. The gradual increase of this density, together with bloody exudation, led to the diagnosis of a malignancy. At autopsy a bronchial carcinoma with generalized metastasis was found.

E. A. MAY, MD

CANCER (THERAPY)

A Clinical Evaluation of Various Qualities of Roentgen and Radium Rays for the Treatment of Advanced Cancer Bernard P. Widmann Am Jour Roentgenol and Rad Ther, November, 1931, XXVI, 729-733

The author first emphasizes that there is no biological proof of superiority of any particular wave length of radiation in cancer therapy. However, 200 K.V. radiation filtered with 0.5 mm copper affords greater penetration at varying depths with less danger of skin damage than 127 K.V. radiation using 6 mm aluminum. Similarly, it has now been proven by two years of practical experience that skin tolerance can be even further increased by combining two qualities of short wave length radiations such as 200 K.V. roentgen irradiation with gamma radium packs (2 mm platinum). However, end-results studied on a statistical basis of a series of 319 cases of advanced cancer treated by this method indicate that no material improvement over the intensive use of either one of these

agents (roentgen rays or radium) was achieved, although, based on clinical impressions, results from the combined method justify recommending it. By combining qualities of radiation, from 230 to 280 per cent S.E.D through a given skin area may be given by protracting treatment over a period of from four to six weeks

J E HABBE, M D

The Advantage of Bacteriologic Examination before Radiation Therapy of Uterine Cancer D den Hoed Strahlentherapie, Nov 14, 1931, XLII, 775-779

Infection represents one of the most serious complications following radium implantation in cases of carcinoma of the uterus. In order to determine the role played by the resistance of the organism in this connection, the author studied the virulence of the bacteria in the vagina by means of the Ruge and Phillip's test. A small amount of secretion from the cervical ulcer is mixed with 10 cc of sterile blood which has been defibrinated. This is then placed on an agar plate in the incubator at 37° Centigrade. Part of the blood is put in the incubator alone. After 1, 2, and 3 hours new samples are taken and new agar plates made. This gives an idea not only as to the type and number of microbes present in the ulcer but also of the bactericidal power of the blood. Patients who have hemolytic streptococci or whose blood has no bactericidal power are treated first locally as well as with vaccines before irradiation.

The author then tabulated the patients according to the reactions observed following radium implantation and compared the period before the Ruge and Phillip's test was done with the period after it had become a routine. It appeared that without the guidance of the test 32 per cent of the cases had reactions lasting from 3 to 5 days, while of those who had been properly prepared only 6 per cent showed reactions for from 3 to 5 days. The author concludes, therefore, that the Ruge and Phillip's test is most valuable in preventing undesirable reactions following intra-uterine radium therapy.

ERNST A POHLE, M D, Ph D

The Carbohydrate Metabolism in Carcinoma of the Uterus after Treatment with Roentgen Rays and Radium I Lucas Arch f Gynäkol, 1930, CXLIII, 389-411 (Reprinted from "Cancer Review" by permission)

The author estimated the blood sugar, dioxvaccine, and lactic acid content in blood, and the alkali-reserve of the plasma, in women with uterine carcinoma before and after treatment with X-rays and radium. The blood sugar showed no constant changes. The lactic acid showed only a transient increase shortly after radiation. From two to four

hours after radiation there was a transient lessening, and after twenty-four hours an increase, of the alkali-reserve. After each further radiation there was a slight increase of the alkali-reserve, but a normal CO₂-fixing power was never reached. The increase in lactic acid and the decrease in the alkali-reserve after radiation were simultaneous. A summary is given of the literature on the subject. The CO₂-fixing power in these women was between 40 and 47 c.c. per 100 c.c. plasma, while the normal range, as given by Van Slyke, is from 53 to 77 cubic centimeters.

E L KENNAWAY, M D, DSc

The Sensitiveness of Carcinoma to Radiation F Voltz. Virchow's Arch f pathol Anat, 1931, CCLXXX, 340-342 (Reprinted from "Cancer Review" by permission.)

From a series of close observations on the reaction of patients with carcinoma to radiation of a carefully standardized variety, the author concludes that the red-blond human type responds less satisfactorily than other human types. He further draws the deduction that the red-blond type is more predisposed to cancer than other human types. He, therefore, addresses an appeal to all radiation institutes and to all pathologic institutes to supply information about the age, color-type, degree of pigmentation (both in normal and irradiated areas), and other details of all patients under treatment for, or dying of, cancer. This information can be supplied on special forms to be obtained from the author.

C E DUKES, M D, M Sc

End-results in the Treatment of Carcinoma of the Cervix with Radium Lewis C Scheffey and William J Thudium Am Jour Obst. and Gynec., August, 1931, XXII, 247-254

The authors report on 150 cases seen from 1921 to 1930, at the Jefferson Hospital, 140 of which were treated by irradiation. Since 1923, no case of cancer of the cervix, early or late, has been subjected to radical operation, irradiation alone being employed. The age incidence is interesting in that 30 per cent of the cases occurred before the age of 40, the youngest patient being 22. Six per cent of the cases occurred in nulliparous women.

Schmitz' classification was employed, and 111 cases, or 76 per cent, fell under class three. Only sixteen, or 10.3 per cent, of the cases were operable. They conclude from these statistics that patients are not seeking advice at an earlier stage than formerly.

Of the three early cases treated by irradiation alone, all, or 100 per cent, have survived five years. Of the fifty-six inoperable patients seen, fifty of whom were treated, eight have survived for five

years, giving a relative five-year curability of 160 per cent and an absolute curability of 14.2 per cent

All cases, regardless of stage, gave a relative five-year curability of 20.7 per cent and an absolute curability of 18.6 per cent

COMPARATIVE FIVE-YEAR STATISTICS, IRRADIATION

| | All cases reported | Percentage of five year cures of all cases | Percentage of operable cases with percentage of five year cures of same |
|---------------------------|--------------------|--|---|
| Mayo Clinic | 1,094 | 21.8% | 21—60.8% |
| Radiumhemmet | 790 | 20.6% | 25.5—40.4% |
| Mercy Hospital | 332 | 17.5% | 21.9—53.5% |
| Woman's Hospital (N Y) | 259 | 24.3% | 25.9—57.1% |
| Rhode Island Hospital | 92 | 17.4% | 20.6—57.9% |
| Jefferson Hospital | 59 | 18.6% | 5.0—100% |

Their technic consisted of the application of radium in a cervical applicator, a total of 3,600 milligram-hours being employed at the present time. The size and filtration of the applicator are not stated. Monel needles of radium element have been occasionally introduced interstitially, directly into the carcinomatous tissue. X-rays have been employed only occasionally in the past, but following the recommendations of Healy, Ward, and a great many others, they are considering the routine employment of roentgenotherapy in addition to the radium therapy.

JACOB H VASTINE, M.D.

Skin Cancer, with Special Reference to Hospital Cases at Bern O Naegeli Schweiz med Wehnschr, Sept 6, 1930, LX, 837-842 (Reprinted from "Cancer Review" by permission)

This is an analysis of 190 cases of primary squamous-celled cancer of the skin and mouth observed from 1914 to 1928 and representing an annual average of 0.85 per cent of the total skin lesions seen during this period. Basal-celled forms were eight times more frequent than squamous, and the sex incidence was unusual in that women were nearly as often affected as men. As to age incidence, no cases were seen below the age of 20, only four below 30, the disease increased rapidly after the fifth decade and fell slightly after the seventh. In more than half the cases the upper part of the face was affected. After giving a list of fourteen precancerous skin lesions, the author says that cancer on a precancerous basis was most often associated with senile keratosis in three cases each with leukoplakia and Bowen's disease, in two cases each with tertiary syphilis, lupus vulgaris, and Paget's disease, in one case each with lupus erythematoses, X-ray dermatitis, nevus, pluriosis

As to treatment, surgery has been used in nevi and in carcinoma of the lips, tongue, and external genitalia, also in all cases of prickle-celled cancer, radiotherapy (with X-rays or mesothorium) in benign growths, in inoperable cancers, and following surgery. In X-ray treatment a single dose of from 15 to 30 units with 3 mm Al filter is given as a routine, the author states that larger doses give no better results. No cases were treated by electrocoagulation, freezing, or caustics.

F CAVERS, D.Sc.

Electrosurgery in Malignant Disease G A Wyeth Internat Jour Med, September, 1930, XLIII, 479-481 (Reprinted from "Cancer Review" by permission)

In this brief note the author assumes that tumors of low differentiation, i.e. showing embryonic features, are of unfavorable surgical prognosis but are highly radiosensitive, and that Broders' classification of tumors is correct, i.e., that the highly differentiated tumors of Grade I are relatively benign while those of Grade IV represent the opposite extreme. He states that for Grade IV cases, Cutler and Healy report 43 per cent of cures by radiotherapy while the Mayo Clinic statistics report only 9 per cent cures by surgery. Hence, biopsy is essential and should be made by diathermic methods. The author invariably uses electrosurgery for operable tumors and claims that this treatment also gives good palliative results in inoperable cases. Many tumors of Grade IV should not be immediately treated surgically, but first given radiotherapy. Above all treatment should not be schematic and one-sided.

F CAVERS, D.Sc.

Results of Radiation Therapy in Inoperable Carcinoma of the Cervix (from 1920 to 1927) E Mühlmann Strahlentherapie, Oct 24, 1931, XLII, 504-509

Before reporting the results obtained in cases of inoperable carcinoma of the cervix, observed during the years from 1920 to 1927, the author briefly reviews the patients seen from 1915 to 1920. In a brass filter of 0.5 to 1.5 mm thickness 25 mg of radium element were used. From 5,000 to 10,000 mg-hrs. were given in the cervical canal or within the growth. Some cases received, in addition, X-ray therapy which, of course, must be considered insufficient in the light of our present knowledge. The first group observed five years or longer consisted of thirty patients, five, or 16.6 per cent of whom were clinically cured. In the second group, consisting of twenty patients observed from three and one-fourth to six years, three, or 13.6 per cent, were cured. In 1920, a deep therapy apparatus was installed and the patients were treated according to the method of Seitz and Wintz. They were observed from one-half to two years following the treatment.

six out of sixteen patients, or 37.5 per cent, were clinically cured.

The method of treatment used, beginning in 1920, was changed very little. The radium available had been increased to from 50 to 75 mg., which was distributed in seven tubes placed in the cervical canal, within the cauliflower growth, or in the fornix of the vagina. Within a week 3,000 mg.-hrs., distributed over 3 or 4 sittings, were given. From eight to ten days later from 100 to 110 H.E.D. X-ray deep therapy were applied. From 1920 to 1922, the Seitz-Wintz method was used, and beginning in 1923, the large field method of Dessauer-Warnekros. In 1924, another method was introduced, using two large anterior and posterior fields and two lateral fields. A total of 238 inoperable carcinomas of the cervix were irradiated with the combined method. After five years, forty-six patients, or 19.74 per cent, remained clinically free from the disease. The author compares this figure with the cure of 16.6 per cent obtained during the period from 1915 to 1918, in thirty cases treated by radium alone. He concludes that the combined therapy has not materially improved the results obtained by radium alone, and suggests, therefore, that the protracted fractional method of Coutard be given a trial.

ERNST A. POHLE, M.D., Ph.D.

Advances in the Method of Treating Carcinoma of the Gastro-intestinal Tract by Roentgen Rays
Hans Holzfelder Strahlentherapie, Oct. 24, 1931
XLII, 497-503

Carcinoma of the stomach can be influenced favorably in about 50 per cent of the cases by intensive X-ray therapy. From 20 to 25 per cent of these patients do not show any evidence of tumor after completion of the treatment. The scirrhus type of carcinoma does not respond as well. The principle of the method is the use of a number of small fields of 6×8 sq cm with compression by means of a treatment cone. On the first day usually two or three fields are used, on the second day two fields, and then daily after that only one field for a period of from four to six weeks. The single dose per field is 300 r (in air), each field receiving a total of from 2,400 to 3,000 r. The technic is similar in cases with carcinoma of the rectum.

Two cases are briefly related illustrating the results which sometimes can be obtained by this procedure. One woman, 53 years of age, was operated on in October, 1928, at the Mayo Clinic. The upper three-fourths of the stomach, including all the posterior wall and part of the anterior wall, was involved with carcinoma. There were also considerable metastases to the neighboring lymph nodes as well as in the omentum. A gastro-enterostomy was not done because there was no obstruction. She started treatment under the author's supervision in Decem-

ber, 1928. She improved considerably, gained weight, and roentgen examination about one year later showed a perfectly normal stomach. In June, 1931, the patient was still well and free of recurrence.

The second case concerned a man, 59 years of age, operated on in the University clinic in Heidelberg, in June, 1929. A carcinoma the size of a fist was found to be adherent to the pancreas. Roentgenotherapy was carried out from August to November, 1930. Roentgenograms are appended showing the slow regression of the tumor until there was complete disappearance. The general condition of the patient also improved markedly. In October, 1931, he was still free from recurrence. The method employed by the author is, therefore, recommended to radiologists for trial in similar cases.

ERNST A. POHLE, M.D., Ph.D.

Multiple Epitheliomas of the Trunk Associated with Parapsoriasis W. Cürrh Dermatol Ztschr, February, 1931, LX, 256-260 (Reprinted from "Cancer Review" by permission)

A woman showed numerous epitheliomas and many patches of parapsoriasis, but nowhere was there a transition from the latter to the former; several sections of both lesions were examined. The epitheliomas cleared up after electrocoagulation followed by X-ray treatment, but the parapsoriasis was intractable to all the remedies tried. The author believes that multiple epitheliomatosis is becoming more frequent [a perusal of current dermatologic literature certainly shows an increasingly large number of case reports].

F. CAVERS, D.Sc.

Summary of Our Experience in the Use of Endothermic Methods in Cancers of the Skin and Mucous Membranes N. Puente Duany, E. Fonts, and M. C. Gomez Bull de l'Assn fran^c p l'etude du cancer, July, 1931, XX, 561-574

The authors are quite enthusiastic over the results obtained by electrocoagulation and the electric bistoury in the past three years. So successful have they been with these endothermic methods that they give them preference over radium. The advantages claimed are that radiotherapy is always longer, and besides the element of time, a larger quantity of radium is made accessible for cases requiring this substance. These endothermic methods facilitate the treatment of a greater number of patients than would be possible with radium treatment.

The electric bistoury has the advantage of bloodless operations on nevi, angiomas, fibromas, etc. The choice of method, either electrocoagulation or the electric knife, or both combined, depends on the size and character of the tumors which are divided

simply in three classes Incipient, small, and large In the first category are included spinocellular epitheliomas, melanomas, nevi, etc., not larger than a pea. In these the disease is completely localized, infiltration very discrete, and cure is practically 100 per cent In the second group are found tumors varying from a pea to a one- or two-franc piece, and in the third group, tumors of large size However, size is not always proportionate to gravity, localization, infiltration, and lymphatic invasion make these forms less accessible to endothermic methods Almost every advantage offered by radium in cutaneous tumors can be accomplished by electrocoagulation or the electric bistoury

Electrocoagulation alone is employed in cutaneous cancers of small size, also in tumors of the conjunctiva and lids, the proximity of the eyeball very often interferes with the use of radium on account of more or less irritation Electrocoagulation is also frequently resorted to in those cases in which small islets have remained undestroyed after radium therapy

Small recurrences on extensive scars of the mouth or skin are well treated with the electric knife followed by electrocoagulation Epitheliomas of the skin of the face, which have been uninfluenced by radium, yield to endothermic methods One of the principal uses of the electric bistoury is the treatment of advanced cases

HENRY BAYON, MD

Diathermocoagulation in the Surgical Treatment of Cancer F F Carranza Bol Inst Med Exp, December, 1930, VII, 1339-1357 (Reprinted from "Cancer Review" by permission)

After discussing the advantages and drawbacks of electrocoagulation, its possibilities in combination with surgery and radium, and its technic, the author gives an account of its use at the Buenos Aires Cancer Institute, in the treatment of carcinoma of the uterine cervix (100 cases), breast (29), vulva (17), and rectum (12), reporting a definite improvement in results as compared with other methods that have been used there

F CAVERS, D Sc

Radiotherapy of Cancer of the Uterine Cervix at the Anticancerous Center of a Parisian Suburb Statistics of the Years 1921 to 1926 Simone Laborde and Y-L Wickham Bull de l'Assn franç p l'étude du cancer, July, 1931, XX, 458-475

The statistics cover a period of ten years Although, inasmuch as cancer is concerned, if five years after treatment there has been no recurrence, the case is usually regarded as cured However, the authors consider that figure as too arbitrary, since

return of the disease has been observed after a much longer time. They have consequently carried their observations for ten years, from 1921 to 1926, extending them from this time to 1931, noticing, as is naturally expected, that the percentage of cures declines but slightly after five years, since, after a time, death is often the result of intercurrent disease

In these observations, cancers of the cervix alone, treated by radiation, figure, cancers of the vagina and post-operative recurrences having been eliminated Epitheliomas of the cervix have been classified in four groups, according to the different degrees of extension of the lesions

The first degree comprises lesions entirely limited to the cervix and considered operable

The second degree includes a juxta-uterine extension with uterine mobility partly preserved, this group comprises cases at the limit of operability

The third degree includes cases in which there is an invasion of the parametrium or of a part of the vaginal wall, with immobility of the uterus, consequently, they are absolutely inoperable.

The fourth degree comprises cases in which neighboring organs (vagina, bladder, rectum) are involved and for which treatment was instituted only as a palliative measure

Five tables are submitted for each year from 1921 to 1926, with the purpose of showing (1) The number of patients examined for cancer of the cervix, (2) the number of patients treated, (3) the number of patients not treated and the causes of their elimination, (4) the number of patients, living and without recurrence, in each of the categories

Following these data, their sum total is condensed in two tables, the model of which has been devised by the Sub-commission of Radiology and the Cancer Commission of the League of Nations In these two tables are enumerated the number of cases treated, the number of deaths, and the percentage of cures in each year from 1921 to 1926, and from 1926 to 1931 Also, the total percentage of cures in each of the four degrees in five years and in ten years, showing the rapid decline of cures, as would naturally be expected considering the stage of disease (80 per cent in the first degree, 50 per cent in the second, and 22 per cent in the third) Patients in the fourth stage usually survived but a few months, and in these cases treatment was expected to accomplish no more than palliation of painful symptoms

Utero-vaginal curietherapy alone has been resorted to for cancers of the first degree In cases of the second and third degrees, roentgenotherapy is associated with curietherapy, roentgenotherapy is usually applied alone in cancers of the fourth degree In the extensive forms involving the vagina, the use of radium involves the risk of hastening perforation of the vaginal walls Surgical treatment following curietherapy has been discountenanced

When extensive cervical granulations are present, even though the cervical canal is free, it is better to carry out the treatment in two stages, the destruction of the granulations which are always infected allowing intra-uterine irradiation to be carried out with less risk of infection. In these cases an interval of five or six days separates the vaginal from the intra-uterine irradiation.

The authors disapprove of the destruction of exuberant cervical granulations by the curette or by electrocoagulation, as these methods favor infection. Doses usually employed, which have proved most favorable, vary between 5,000 and 7,000 milligram-hours, larger doses often being harmful as they interfere with cicatrization.

The authors condemn short irradiations of a few hours, such as is the custom in America, nor do they approve of irradiations prolonged from twenty to twenty-five days, which, on account of frequent manipulations, might be followed by infection. They consider an average duration of from four to six days, when the irradiation can be accomplished in one stage.

An attempt is made to establish the effect of treatment according to the histologic form of cancer of the cervix, as some forms are more radiosensitive than others, and after a lengthy discussion they finally conclude that treatment is successful in proportion to the degree of invasion, regardless of the histologic type.

In conclusion, the statistics here presented demonstrate that the number of uterine cancers in the first degree which were treated by radiotherapy in this series is small. However, the authors are receiving more patients referred to them by internists and surgeons. It seems that radiotherapy is gradually superseding surgery in the treatment of cancer of the uterine cervix.

HENRY BAYON, M.D.

CHEST (DIAGNOSIS)

Three Interesting Lung Cases F. Forman. Jour Med Assn South Africa, Aug 22, 1931, V, 515-519

I. *Syphilis of the Lung*—A female, 37 years of age, was admitted to the hospital, complaining of cough with expectoration. For nine months prior to admission she had noticed cough, weight loss, night sweats, capricious appetite, and nausea and vomiting.

Physical examination showed evidence of moderate weight loss. The left side of the chest was flattened, showed restriction of movement, was dull to percussion, with increased tactile fremitus and bronchial breath sounds. There was also tachycardia and rather high temperature.

X-ray examination revealed diffuse nodular infiltration of the entire left lung, with glandular enlargement in each hilus, the appearance being con-

sidered suggestive of tuberculosis. Sputum examination was, however, repeatedly negative, while the blood Wassermann was positive. While there was no clinical evidence of syphilis, under anti-syphilitic treatment the patient made rapid improvement. X-ray study about one month after admission showed almost complete resolution of the process in the left lung, hence it was no longer felt that the lesion was tuberculosis.

While the writer recognizes the fact that the therapeutic test is not conclusive, he nevertheless considers the accumulated evidence distinctly in favor of the diagnosis of pulmonary syphilis in this case, and believes the occurrence of this form of syphilitic disease to be more frequent than is generally considered.

II. *Pulmonary Actinomycosis*—An European male, 22 years of age, was admitted to the hospital, with a swelling of the right fifth rib. He was known to have been running a temperature for the past six weeks and had a slight cough with scanty greenish-yellow sputum.

About five years prior to admission he had been ill with pain in the right chest, and cough. During this illness he had on several occasions coughed up large quantities of malodorous pus, these copious expectorations being followed shortly by almost complete recovery, except for slight cough and scanty sputum.

Examination revealed a pulse of 90, temperature of 100°, and dullness over the right base and in the mid-axillary line. There was a small swelling over the lower half of the right fifth rib in front, the swelling being firm and elastic, not red, but adherent to the underlying rib. This was incised, typically actinomycotic pus with golden granules being evacuated, and the ray fungus was demonstrated.

X-ray study on admission showed a small patch of nodular infiltration at the right base but no evidence of rib abnormality. During his stay in the hospital he developed first a left-sided pleural effusion and later a right-sided effusion, each of which cleared rather promptly. Fluid withdrawn from the right pleural cavity was clear and sterile. Sputum studies were persistently negative for tubercle bacilli, ray fungus, or any demonstrable organism. Final X-ray study some months after first admission to the hospital showed an essentially negative chest. The therapy in the meantime had been large doses of iodides and vaccine therapy. It was assumed that the chronic lung condition was actinomycotic, with apparent recovery.

III. *Amebic Abscess of the Lung*—A male, 31 years of age, was admitted to the hospital with a temperature of 102.6°, pulse of 108, and respirations of 32, his complaints being cough, with copious expectoration of pinkish, foul-smelling sputum, and diarrhea, with mucus in the stools. For a number of months prior to admission these symptoms had been present in variable degrees.

Examination showed flattening and limitation of motion of the right lower chest, dullness to percussion from the inferior angle of the scapula downward, with tubular breathing, numerous moist sounds, and diminished vocal fremitus. The liver edge was felt three inches below the costal margin and was quite tender to palpation. Sigmoidoscopic examination revealed numerous typical amebic ulcers. The diagnosis was amebiasis, amebic dysentery, amebic hepatitis, with abscess extending to involve the base of the right lung with pleural effusion.

X-ray examination revealed a moderate quantity of fluid. After this was withdrawn a lung abscess, not connected with the diaphragm, could be demonstrated.

Under antiamebic treatment (emetine yatren, and stovarsol), he made rapid and complete recovery.

J. E. HARBE, M.D.

A Report of Two Cases of Localized Pleural Effusion in Heart Failure. J. Murray Steele. Am Heart Jour., December, 1931, VII, 212-222.

The author cites the rare cases of localized pleural effusions attributable to heart failure, and adds two cases of his own, one with an effusion localized in the upper half of the right thorax, and the other with an effusion encapsulated in the right interlobar fissure.

Both patients had clinical signs of heart failure, and chest plates showed the localized effusions and enlarged hearts. After recession of the cardiac symptoms, chest studies showed the disappearance of the fluid and reduction in cardiac size. Recurrence of the heart failures showed in each instance a reaccumulation of the fluid and dilated hearts. One patient recovered from his second attack and showed once more the disappearance of the fluid and reduction in heart size, the other patient died, and autopsy revealed the dilated heart and localized pleural effusion. The fluid proved to be a transudate, confirming its origin in the heart failure.

Further, autopsy revealed on the right side a thickened pleura that had obliterated the entire pleural cavity except in the region of the effusion. This finding and a similar instance in the literature lead the author to conclude that localized pleural effusions in heart failure depend upon a pre-existing adhesive pleurisy.

NATHAN FLAX, M.D.

Roentgenologic Observation of Recurrent Perifocal Inflammatory Processes in Chronic Bronchiectasis. Gerhard Strocka. Röntgenpraxis, Sept 15, 1931, III, 839-843.

The clinical differentiation between retention of secretion in bronchiectasis and perifocal (pneumonic) lesions is very difficult. The bronchopneumonic areas are usually too small for clinical detection, a roentgenologic examination being helpful. Sometimes the complication of bronchopneumonic foci around the bronchiectasis might be the first sign of the disease. Certain cases of that nature are reported. To the author it appears questionable whether the temperature and acute sickness, supposedly caused by retention in bronchiectatic cavities, may not be due to a perifocal infection.

H. W. HEFKE, M.D.

Bronchial Neoplasms. Roentgenologic Aspects. W. F. Manges. Arch. Otolaryngol., December, 1930, XII, 732-738. (Reprinted from "Cancer Review" by permission.)

The author deals with diagnosis, emphasizing especially the importance of bronchography and of biopsy. As to treatment, he advises large doses of X-rays over several fields. He mentions two cases which are alive six and one-half and seven years after the diagnosis was made (but does not state whether or not this was histologically verified).

F. CAVERS, D.Sc.

The Borderline between Normal and Pathologic in the Chest Roentgenogram. Felix Fleischner. Röntgenpraxis, Oct 15, 1931, III, 913-926.

The many different appearances of normal and pathologic chest roentgenograms are described. Particular attention is called to borderline cases, in which it is difficult to say whether the findings should be considered pathologic or a variation of the normal. Emphasis is laid on the importance of good chest films, which should be made with as low a voltage as possible and in as short a time as possible. Many points are given which help to interpret the roentgenologic signs.

This very interesting article cannot be reviewed here in detail, but must be commended for study in the original.

H. W. HEFKE, M.D.

Encysted Empyema, with Special Plate. N. D. Patel. British Med. Jour., Dec 5, 1931, No. 3700, p. 1032.

Encysted empyemas are not very rare conditions. They are difficult to diagnose without the help of X-ray, lipiodol, exploratory needle, or artificial pneumothorax. The collection of pus, often pneumococcal, but sometimes tuberculous, may occur in one of the interlobar fissures, between the diaphragm

and the under surface of the base of the lung, between the lung and the pericardium, or in the general pleural cavity, in the pockets formed by the adhesions of the parietal and visceral layers of the pleura

A case is reported at length of a collection of pus in a rare position, namely, between the lung and the right margin of the heart

X-ray examination of the chest showed that the heart was normal in size and in position. The lungs also showed no lesions but a triangular shadow opposite the right second and third costal cartilages just above the right border of the heart. It was homogeneous, and had clearly defined margins. A diagnosis of an encysted empyema was made

WALLACE D MACKENZIE, M.D.

Destructive Processes in the Sternum. Adalbert Low-Berl Röntgenpraxis, Sept. 15, 1931, III, 817-830

The roentgenologic demonstration of the sternum is somewhat difficult, as it must be projected away from the shadow of the spine and the mediastinum. Neoplastic processes, as well as inflammatory processes, may lead to areas of destruction in the sternum. Six cases are described. One of metastases from a thyroid carcinoma, one of metastases from a breast carcinoma, another shows a diffuse invasion by tumor tissue, which probably was a sarcoma, a fourth case shows roentgenologically areas of destruction without proliferation (autopsy proved the presence of a sarcoma secondary from a retrobulbar tumor), the fifth was a case of syphilis, and the sixth, one of chronic osteomyelitis. The localization of the changes was in the manubrium in the fifth and sixth cases

H W HEFKE, M.D.

X-ray Diagnosis of Diseases of the Chest. Proc. Royal Soc Med., Sect. of Radiology, Nov 20, 1931. British Med Jour., Nov 28, 1931, No 3699, pp 990-992

In discussing pulmonary tuberculosis it was concluded that definite infiltration could be demonstrated on the X-ray film as soon as there was any clinical evidence, and that the film usually showed far more evidence of disease than was obtainable by means of physical examination

Passing on to consider lung abscess, the non entrance of lipiodol was stressed as the greatest confirmatory evidence available, as lipiodol rarely enters a lung abscess

As to benign neoplasms, it must be remembered that they were benign only in the pathologic sense. All are extra-pulmonary, the commonest being fibromas, which grow almost invariably from the

posterior thoracic wall, and very often from the head of a rib. Teratomas are anterior in position, more irritant, irregular in shape, and cause adhesions to lung tissue from which they are not easily separated. The diagnosis is made from the perfectly straightforward evidence of a film in the lateral plane, in which the growth is seen to have its origin from the mediastinum in the anterior part

The commonest malignant condition of the lungs, namely, primary bronchial carcinoma, is apparently increasing. This increase is probably due to improved methods of diagnosis in the last twenty years. Carcinoma is classified in the simplest possible way, namely, the two forms in which the disease is most often seen—the lobar, or pneumonic, and the hilar form. The former is due to a combination of growth and collapse, in the hilar form there is growth without collapse, and this might be readily converted into the lobar or pneumonic form.

The thoracic contents are always diminished by primary lung cancer. On closer study of a radiograph of lobar carcinoma it is observed that the opacity is most dense near the root, and diminished in intensity towards the periphery. There is no doubt but that carcinoma of the lung is the commonest cause of bronchial stenosis and of phrenic paralysis. The nerve is at first compressed, and later infiltrated, by the glands

A less well-known disturbance associated with carcinoma of the lung is compression or invasion of the vagus. The resulting effect is disturbance of the cardiac rhythm, not to be distinguished antemortem from malignant invasion of the heart muscle. Much more often abdominal symptoms result from vagal irritation in the thorax, the commonest being complete or partial gastrospasm, while in rarer cases there may be spasm of the lower end of the esophagus. Very rarely a lung cancer compresses the esophagus directly and gives rise to vomiting.

The visualization of large bronchial or mediastinal glands is a most valuable diagnostic point, and one of considerable significance, as it contra-indicates surgical intervention. The chief conditions simulating lobar carcinoma are tuberculous pneumonia, syphilis, and aneurysm, but it should not be forgotten that a combination of aneurysm and growth is possible.

It is doubted whether or not to-day abdominal operation for malignant growth is justifiable before an X-ray film of the chest is taken, as it is useless to operate on a malignant mass in the stomach when there is a carcinomatous growth in the chest.

WALLACE D MACKENZIE, M.D.

CHEST (THERAPY)

Contribution to the Roentgenotherapy of Actinomycosis of the Lungs. Max Lüdin Strahlentherapie, Oct 24, 1931, XLII, 466-470

Reports in the literature regarding unsatisfactory results with roentgenotherapy in actinomycosis of the lungs usually state that in spite of high doses the patient did not improve. The author describes a case of this type, with involvement of the left lower lung and fistula. Potassium iodide was not very effective. Roentgenotherapy was given through four fields over the diseased part of the lungs, each field receiving 200 r (160 KV, 8 mm. Al, 25 cm FSD, 10 X 10 sq cm field). Following this first series of X-ray therapy the patient improved considerably. The fistula closed, pain temporarily disappeared, and the general condition was much improved. Following a three months' sojourn in Switzerland, the patient received a second series and at the same time potassium iodide was given internally. He has gained 8 kilograms since the first treatment. The roentgenogram shows only thickening of the pleura. This case is undoubtedly clinically cured. Although one case does not definitely prove the efficacy of roentgenotherapy in actinomycosis of the lung, it is suggested that the same dosage be tried in similar cases.

ERNST A. PÖHLE, M.D., Ph.D.

CONTRAST MEDIA

Some Sialograms L. N. Pyrah and P. R. Allison
British Med Jour., Dec. 5, 1931, No 3700, pp 1028-1030

The lipiodol injection is made with a metal syringe and a modified lachrymal duct needle made of silver, having a blunt, slightly bulbous end. It is malleable, and the curve can be adjusted to suit any given case. The needle is fitted to the body of the syringe by a screw attachment. The syringe, needle, and lipiodol are warmed, so that there is then no difficulty in driving the lipiodol through the rather fine-bore needle.

Parotid Gland—The needle of the loaded syringe is brought up to the orifice of the duct and is steadied by the surgeon resting it upon his left thumb. It is slid into the duct for about an inch. The introduction of the needle causes a slight cutting pain, but not sufficiently intense to cause undue discomfort.

The injection is continued gently until the patient experiences a sensation of discomfort in the region of the parotid gland, this indicates that the finer ducts are filled with lipiodol. From about 0.5 to 1 c.c. is used. The needle is quickly but gently withdrawn, and the patient is immediately placed in the recumbent position on the X-ray table.

Submaxillary Gland—The needle is introduced as before, but the procedure usually presents more difficulty than in the case of the parotid duct.

The X-ray technic is as follows:

(1) *Parotid Gland*—The patient lies on his side,

and the radiographer places the head (as accurately as possible) in the lateral position, so that the two rami of the lower jaw are superimposed. The head is hyperextended so as to open up the space between the jaw and the vertebral column. The mouth is opened and is retained in this position by a cork, which is placed between the incisor teeth. With the patient in this position, the greater part of the shadow of the gland is in front of the shadow of the cervical vertebrae.

(2) *Submaxillary Gland*—A lateral radiogram is taken here. The patient's mouth is fully opened and the tongue is pressed upwards to the roof of the mouth. There is usually no shadow of bone overlying that of the gland, but in some cases the hyoid shadow may be superimposed.

The uses of sialography are listed as follows:

(1) In some cases of chronic parotitis with subacute exacerbation, sialography reveals that one essential feature in the pathology of the disease is a dilatation of the ducts and of the alveoli.

(2) A sialogram is of value in helping to decide whether a tumor in the neighborhood of a salivary gland is derived from the gland tissue or from adjoining structures. In the former case the gland may be largely destroyed and there may be a considerable filling defect on the sialogram, while in the latter case, even though the gland may be somewhat displaced, it will show normal filling.

(3) Injection of lipiodol may be of assistance in the localization of calculi.

(4) The precise position and track of a salivary fistula, more especially of the parotid gland, can be traced very easily by means of a sialogram.

WALLACE D. MACKENZIE, M.D.

A New Method for the Injection of Lipiodol
Ernest Fletcher British Med Jour., Nov. 7, 1931,
No 3696, p 846

There are two possible methods of injection—the intralaryngeal (usually called the oral route), and injection through the crico-thyroid membrane direct into the larynx.

An attempt has here been made to simplify the technic of injection through the crico-thyroid membrane and to dispense with the necessity of a general anesthetic for child cases.

The apparatus is a 20 c.c. syringe with a barrel greater in diameter and thus shorter in length than the one generally in use. The usual thumb-piece has been replaced by a lever. The piston is attached to the working arm of this lever by a rod, and into the other arm is screwed the barrel of the syringe. The rod is attached to the piston by a universal joint. A spring is inserted between the two arms of the lever to keep them constantly apart and to bring the piston up the barrel. To the end of the

barrel is attached a bayonet joint. A filling tube is provided. A special trocar-pointed needle with lateral holes fits the syringe. On this needle a shoulder may be placed, if desired, to prevent its penetrating the larynx beyond a certain point.

The injection may be made through the crico-thyroid membrane or between two of the upper rings of the trachea, and has been found more rapid, painless, and efficient than other methods previously in use for injection through the crico-thyroid membrane.

The original article gives the name of the makers of a syringe of this type.

WALLACE D MACKENZIE, MD

CYST

Paradental and Traumatic Cysts of the Jaw
O Schneider Ztschr f Stomatol, January, 1931,
XXIX, 80-96 (Reprinted from "Cancer Review" by
permission)

The cysts dealt with here are to be distinguished from the better known radicular and follicular dental cysts. The author first describes two cases of paradental cysts (in a man, 44 years of age, and a woman, 50 years of age). These resemble ordinary dental cysts in general structure, the epithelial lining is produced by reactive proliferative growth, corresponding to what is sometimes seen in gingivitis. He then deals with three cases of traumatic bone cysts of the jaw, which are devoid of epithelial lining or may contain epithelium derived secondarily from the buccal mucosa.

The author says these cysts have nothing to do with localized osteitis fibrosa but form an independent lesion arising by medullary hemorrhage. They are, therefore, commoner in the lower jaw, which has a single central artery. There is a list of fifty-one references (all German), beginning with Virchow (1876). The roentgenograms are good.

F CAVERS, D Sc

Hydatid Disease in England James F Brailsford
Brit Jour Radiol, September, 1931, IV, 440-450

In man the average frequency of hydatid cyst locations are: Liver 70 per cent, lungs 10 per cent, kidney and spleen, each 2.5 per cent, other abdominal organs 5 per cent, muscles and cellular tissues 5 per cent, brain 5 per cent, and bone 1 per cent. In the lungs the cyst may rupture into a bronchus and cure take place, however, the same accident may produce serious hemorrhage, pulmonary edema, shock, and even death. Of human infections 25 per cent show multiple cyst involvement.

Recognition of hydatid infection may first take place through roentgenologic study. Most commonly, of course, the chest findings are most suggestive

The appearance of the cyst will depend upon its condition, hence if simple and unruptured, it will be represented by an ovoid shadow, uniform in density, and with sharply defined margins, with no changes from the normal in the surrounding lung tissue. The lesion may be either single or multiple. If, however, the cyst has ruptured into a bronchus, it may be entirely empty and simulate a "pleural ring." Occasionally the cyst wall undergoes calcification. Differentiation must be made from fibroma, primary or metastatic sarcoma, dermoid cyst, pyemic abscess, and aneurysm. Hydatid cyst formation in the abdominal organs or skull is much more difficult to demonstrate and recognize, although occasionally the abdominal cysts will show calcification of their walls and the intracranial cysts may produce erosion of the inner table or displacement of the pineal gland. Positive precipitation and intradermal tests contribute greatly to the diagnosis, while the finding of hydatid membrane, scolices, or hooklets in the sputum, vomitus, or excreta is the most conclusive evidence of the disease.

J E HABBE, MD

DIATHERMY

Electrical Treatment of Neuritis and Writer's Cramp W Black Jones British Med Jour, Sept 19, 1931, No 3689, p 531

The method adopted by Davies consisted, first, of testing for the affected spot, the negative pole of a faradic current is connected with a conical-shaped electrode covered with wash-leather, the positive being a large pad, which is connected to the arm or leg. Both electrodes are moistened with saline solution. The faradic current is so regulated that it will excite pain in the diseased spot, but will not cause pain in a healthy nerve. When the spot is touched with the electrode and pain is felt, the position is marked. The second stage is that of treatment, and for this purpose the galvanic current is employed. An insulated needle is connected with the negative pole, the large pad remaining positive. A local anesthetic is next injected under the dermis, the needle is inserted, and the current is turned on, the needle is directed to the point at which the pain is most acute. The current should not exceed 6 ma., the needle is withdrawn after ten minutes.

Here the technic is modified slightly. The current generally used does not exceed 1 ma., frequently it is 0.2 milliampere. It is found that five minutes is sufficient for the treatment, frequently after four minutes the patient states that the pain is diminishing. Two spots are often treated at one sitting.

The general results of the treatment show that in cases in which one or two spots occur on a par-

ticular nerve, the action of the current gives immediate and permanent relief. If the faradic current is again applied to the spot after an interval of a few days and no pain is felt, it is concluded that the spot is cured. Thus, when a spot has been treated, no second treatment is necessary. Occasionally when a spot is found there may be felt under the skin a small nodule, which disappears with the application of the galvanic current, the nodule may be a deposit of uric acid. On the other hand, when the number of spots is multiple and when they are close together, the results are not so satisfactory and the relief is often only partial, or it may be some time before a moderate amount of success is obtained, this is assisted by the internal administration of iodine.

Illustrative cases are reported.

WALLACE D MACKENZIE, M.D.

DOSAGE

Our Experience with the Protracted Fractional Dose Method W Dieterich and I Umbach Strahlentherapie, Oct 24, 1931, XLII, 510-513

The authors tried the method of Coutard in a number of advanced tumor cases. Their technic was as follows: 219 K.V., 4 ma, 3 mm Zn, half value layer in Cu 21 mm, 40 cm FSD, 10 X 15 cm field, HED = 550 r. Each area received 185 r in one sitting, and thus dose was repeated every other day until 3,000 r had been applied. The treatment extended over a period of four weeks. Practical experience seemed to show that less filtration, for instance, 0.5 mm Zn + 1 Al leads to similar results.

It is assumed, therefore, that not the heavy filtration, but the distribution of the total dose over a long period represents the most important factor of the method. In certain patients the results were remarkable, while others did not respond at all. In view of the high cost of the treatment and also the danger of late reactions, this treatment method should be employed with great caution and only in selected cases.

ERNST A. POHLE, M.D., Ph.D.

THE ESOPHAGUS (DIAGNOSIS)

Esophageal Varicosities or Carcinoma? Klaus Pohlndt. Röntgenpraxis, Oct 1, 1931, III, 889-895

The roentgenologic differential diagnosis between a carcinoma and varicosities of the esophagus is sometimes very difficult. Multiple small filling defects may be present in both, the only differentiation of importance being the slight narrowing and fixation of a cancer as compared with varicosities. An

esophagoscopy does not always settle the question, as is shown in a case described. Absence of normal elasticity and involvement of only a small portion of the esophagus are points tending to indicate a malignant growth.

H. W. HEFFE, M.D.

Symposium on Esophagus Diverticula Frank H Lahey Laryngoscope, January, 1932, XLII, 71-75

A. C. Crump began his discussion with interesting statistics on the incidence of the common types of pathologic conditions found in the esophagus.

"On a combined admission of about 500,000 cases in 10 years in the Presbyterian and Bellevue Hospitals, there were only 665 cases of disease of this organ, a little over 0.2 per cent. Of these, over 50 per cent were carcinoma, cardiospasm, 4 per cent, stricture, 7 per cent, and diverticula, 3 per cent."

In examination of the esophagus, he believes that a fluoroscopic study should precede any instrumentation. He does not state, however, if he thinks the ordinary liquid barium mixture is satisfactory or if gelatin-barium bougies should be used in conjunction.

Crump closed his discussion with the presentation of a case of cardiospasm in a herniated stomach and doubted if "X-ray control" of the dilating instrument was helpful, even in normal stomachs, since the cardia is very variable and can be moved as much as four inches.

HILLYER RUDISILL, JR., M.D.

Preventricular Dilatation of the Esophagus (Luschka), and the Process of Emptying the Esophagus L. Huismans München med Wchnschr, Aug 28, 1931, LXXVIII, 1488, 1489

Luschka, in his publication, in 1857, distinguished between the antrum cardiacum below the diaphragm, and a dilatation above the diaphragm. Leichtenstern reported a case and the author of the present paper adds another, in which a noticeable dilatation of the distal end of the esophagus was found. The author also discusses the physiology and the function of the esophagus.

E. A. M. M.D.

Röntgenologic Diagnosis of Lesions in Esophagus A. P. Overgaard Nebraska St Med Jour, September, 1931, XVI, 350-352

The roentgen ray with barium meal is the most important procedure in diagnosing diverticula of the esophagus. They are usually located on the lateral or posterior wall of the tube. They are rare at the

lower end of the esophagus, and when found there are usually on the anterior wall and may be mistaken for partial herniation of the stomach. In addition to diverticula, deviations and deformities due to neoplasms are usually capable of early diagnosis. Late diagnosis and ineffective treatment of cancer of the esophagus are a reproach to the medical profession. Herniation of the stomach through the diaphragm often passes undiscovered and when this occurs through the esophageal orifice, roentgen-ray study is of the utmost importance. Examination in the horizontal position is necessary to detect this lesion, but it is usually necessary to examine in the erect, supine, and oblique positions.

W W WATKINS, M D

Partial Pharyngeal Paresis as a Roentgenologic Symptom in Diseases of the Esophagus G v Pannewitz Fortschr a d Geb d Röntgenstr, August, 1931, XLIV, 170-177

On fluoroscopic examination of the diseased esophagus, the author found residues of contrast medium in the valvulae epiglotticae and the sinus piriformis in 38.5 per cent of the cases. This observation was made chiefly in cases of esophageal carcinoma. A paralysis of pharyngeal muscular elements must be considered responsible for the phenomenon. In its presence a particularly careful search of the entire esophagus and chest is indicated, as it was never found without the presence of important pathology. Its absence, of course, does not rule out the existence of esophageal disease.

(*Abstractor's Note*—The closer the lesion is located to the pharynx the more regularly the disease appears to occur.)

HANS A JARRE, M D

Peptic Ulcer of the Esophagus J Richards Aurchus Am Jour Roentgenol and Rad Ther, November, 1931, XXVI, 696-703

Peptic ulcer of the esophagus is a definite disease entity, despite the paucity of case reports in the literature. Until recently the lesion was found and reported only at postmortem examinations, but with recent improvements in esophagoscopy examinations clinical diagnoses are being proved, although there is still very little in the literature concerning the roentgenologic diagnosis.

The cardinal symptoms are pain, usually near the lower end of the sternum, dysphagia, nausea and vomiting, and occasionally hemorrhage. These are most apt to be confused, therefore, with high-lying gastric ulcers. The lesion usually involves the lower third of the esophagus and is observed oftenest in middle age, the two sexes showing about equal frequency of involvement. The most significant roent-

genologic finding is the niche, with secondary signs of regional spasm and lagging of the barium mixture also being often seen.

The case herein reported was of a white male, aged 40, who had had symptoms of a burning pain in the epigastrium for a period of three years prior to examination. The diagnosis was suggested by repeated roentgen study which revealed the stomach, duodenum, and gall bladder to be normal, but showed a suggestive niche shadow near the cardia. Esophagoscopic examination confirmed the diagnosis, and repeated topical applications of 5 per cent silver nitrate through the esophagoscope for a period of two months were followed by apparent cure. Peptic ulcer of the esophagus requires differentiation from other types of ulcer, such differentiation being most largely dependent on the history of the case.

J E HABBE, M D

EXPERIMENTAL STUDIES

Radiobiologic Studies on Fertilized Sea-urchin Eggs H and M Langendorff Strahlentherapie, Nov 14, 1931, XLII, 793-799

The authors studied the radiosensitivity of sea-urchin eggs at different stages of mitosis. At intervals of five minutes following impregnation 200 r were applied. There was a maximum at five minutes, a minimum at thirty-five minutes, and a second maximum at fifty-five minutes. Fractional doses of 2 X 100 r were given at five and thirty-five minutes, thirty-five and fifty-five minutes, and nothing and fifty-five minutes after impregnation. The results confirmed the author's expectations, the mitotic stage influences also the effect of fractional exposure. The ovum is the least susceptible to irradiation during the metaphase, but very susceptible before and after that stage.

ERNST A POHLE, M D, Ph D

Experimental Study in the Biological Effect of Roentgen Rays I Effect of Roentgen Rays on the Blood Constituents of Splanchnicotomized or Vagotomized Dogs II The Mechanism of the Decreased Blood Sugar Caused by Roentgen Rays Shoji Kikuchi Tōhoku Jour Exp Med, 1931, XVII, 545-578

Irradiation of dogs causes an increased blood sugar (from 25 to 50 per cent) reaching a maximum in from three to seven hours. The size of the dose and the site are comparatively unimportant. The serum pH does not change. The serum protein is variably affected, but, like the total N, usually shows an initial increase. If the liver area is irradiated,

there is a very large increase in total N. The blood non-protein N usually shows either no increase or a slight increase, but if the liver area is irradiated, there is a very significant rise. Serum Cl decreases, the extent varying with the amount of irradiation. An initial decrease in the inorganic P is followed by a marked increase. The acetone bodies increase only if the liver area is irradiated, and then in proportion to the size of the dose. A slight increase in lactic acid is followed by a decrease. All these values return to normal within twenty-four hours. Following splanchnicotomy, irradiation causes a decreased blood sugar, and does not affect lactic acid or the total acetone bodies. Vagotomy does not appreciably change the effects of irradiation. The significance of these findings is discussed.

Lymph taken from the thoracic duct of irradiated dogs and injected into rabbits does not affect the blood sugar. If the dog's splanchnics had been sectioned before irradiation, his lymph caused a marked fall in blood sugar. Presumably, irradiation stimulates the parasympathetics in such animals, releasing pancreatic hormone into the lymph and thence into the blood, explaining the fall in blood sugar observed after the irradiation of splanchnicotomized animals.

CHEMICAL ABSTRACTS

Mice as Indicators of the Presence of Carcinogenic Nova in Factories O Teutschlaender Deutsche med Wchenschr, Dec 19, 1930, LVI, 2166, 2167 (Reprinted from "Cancer Review" by permission.)

A wild grey mouse which was caught in a briquette factory was found to have spontaneous tar cancer, probably produced by pitch dust. This leads the author to suggest that since mice are more susceptible than men to various carcinogenic substances, they might be usefully employed as test subjects in various workshops, also in the so-called cancer houses, for carcinogenic nova (tar, aniline dyes, X-rays, etc.)

F CAVERS, D Sc.

Influence of Radiation Energy on the Mineral Elements of the Blood St. Malczynski, A Borysiewicz, and T Toczycki Compt. rend. Soc. de biol., Oct 12 1931, CVIII, 165-167

The experiments were made on healthy dogs submitted to ultra-violet radiation from a quartz lamp, to the administration of ergosterin, irradiated by a quartz lamp, and to X-rays.

The results were that under the influence of ultra-violet radiation there was an increase of almost all the mineral elements, especially calcium and phosphorus, and to a lesser degree potassium and sodium.

The alterations resulting from X-rays were much less characteristic, especially regarding those of phosphorus, potassium, and sodium. The authors have observed a general tendency towards a lowering of these elements, for calcium, this lowering was more distinct and quite characteristic.

The effects of irradiated ergosterin were more or less similar to those of the quartz lamp, the differences consisting in greater intensity and longer duration from the quartz lamp. The effects produced by irradiated ergosterin rapidly subsided, the initial values very soon returning on the discontinuance of its administration.

The authors believe their experiments prove that ultra-violet radiation and irradiated ergosterin are stimulants, whereas X-rays have a rather slowing effect on the mineral metabolism of the healthy animal.

HENRY BAYON, M D

Experimental Investigations Concerning the Roentgenologic Demonstrability of Pulmonary Connective Tissue. Oskar Meller and B Menkes. Fortschr a. d Geb d Röntgenstr, August, 1931, XLIV, 197-204

This is a very instructive and important paper based on the application of modern conceptions of colloidal chemistry upon our teachings of inflammation. The lungs of young children were removed from the corpses and permitted to hydrate in 5 per cent acetic acid solution. They were roentgenographed and equally inflated under identical technical conditions. There was a marked increase in pulmonary markings during the stage of hydration. It is evident that we will have to pay more attention to the mesodermic pulmonary structures in roentgenologic interpretation.

Further studies on the effects of hydration and dehydration of colloids under the influence of H and HO ions are very important for our conceptions of inflammation and its effects.

Literature may be found under the names of Bechtold, Schade, Menschel, and Roessle. Very interesting and instructive illustrations accompany this article.

HANS A JARRE, M D

Comparative Study of the Action of X-rays on the Adult Thymus and on the Embryonic Thymus. A-P Dustin and Ch Grégoire Compt. rend. Soc. de biol., Sept 18, 1931 CVII, 1565-1567

During experiments undertaken with an altogether different purpose, in which pregnant guinea pigs were irradiated the authors' attention was attracted by reactions of the embryonic thymus, suggesting

the investigation, not as yet undertaken, of modifications of the thymus to X-rays in the different phases of its histogenesis

In pregnant females, the thymus presents a state of involution which increases with the age of the animal and as the pregnancy advances. The involuted thymus is sclerosed, poor in thymocytes, containing none but old thymocytes because the process of regeneration is retarded, consequently such organs are but slightly affected by radiation. Pyknosis being sluggish, consecutive phagocytosis is inactive, the thymus reacts under such conditions very much in the manner of the medullary region (more radioresistant) of the normal thymus.

In the fetus, pyknotic degeneration is rapid and massive under the influence of radiation and appears only in the fetus in which the thymus has undergone pseudo-lymphoid transformation. Before this stage the thymic cells are no more sensitive than the surrounding tissues. When, on the contrary, the small thymic cell is developed, it at once acquires a decided hypersensitivity to radiation.

The effects of radiation on the appearance of Hassall's corpuscles is described, the guinea pig being particularly favorable to demonstrate the relations of these corpuscles to the fibro-vascular trabeculae, their paravascular origin is evident. After radiation they develop all along the vascular framework, even in the cortical substance, undergoing considerable hyperplasia, thus being a typical example of the interrelation between thymocytic involution and the evolution of Hassall's corpuscles.

HENRY BAYON, M.D.

THE EYE (DIAGNOSIS)

Report of Small Tumor of the Iris which caused Secondary Glaucoma, Microscopic Examination, Remarks on the Relation of Melanoma to Sarcoma of the Iris. A Knapp Trans Amer Ophthalmol Soc., 1930, XXVIII, 118-125 (Reprinted from "Cancer Review" by permission.)

This tumor, a sarcoma, occurred in a man, 30 years of age, who had for about nine years complained of a brown spot on the right iris between three and five o'clock and had noticed dimming of vision for a few weeks before examination. The anterior chamber was deep, pupil 8 mm in diameter and immobile, and the intra-ocular pressure was 42 mm Hg. Trehphining was done, but a year later the brown mass had become larger, malignancy was diagnosed, and the eye removed.

F CAVERS, D.Sc.

Large Osteoma of the Orbit. J N Roy Ann d'Ocul, October, 1930, CLXVII, 825-832 (Reprinted from "Cancer Review" by permission.)

The tumor was a typical simple osteoma with the usual clinical and X-ray features, but the report is of interest because despite the large size of the mass, which involved the floor of the frontal sinus and was associated with marked exophthalmos, fixation of the eye, and diplopia, its removal was effected without interference with the eyeball and with restoration of normal vision. The patient had prudently slept with the eye bandaged, hence there was no corneal ulceration such as frequently results in such cases from inability to close the lids.

F CAVERS, D.Sc.

THE EYE (THERAPY)

Primary Sarcoma of the Iris Removed by Iridectomy, No Recurrence in Three and a Half Years. W Zentmayer Trans Am Ophthalmol Soc., 1930, XXVIII, 109-115 (Reprinted from "Cancer Review" by permission.)

The patient, a boy 10 years of age, had a tumor, first noticed four months previously—which was a swelling 5 X 3 mm on the pupillary margin of the iris and translucent on a slit-lamp examination. On removal the tumor proved to be a spindle-celled sarcoma with no definite intercellular substance and with blood-vessels lined only by endothelium. Post-operative X-ray treatment was given five times, in all 175 per cent of an erythema dose.

F CAVERS, D.Sc.

X-ray Treatment of Retinal Glioma. E Janson Klin Monatsbl f Augenh, October, 1930, LXXXV, 542-546 (Reprinted from "Cancer Review" by permission.)

In a one-year-old girl the left eye was enucleated on account of retino-blastoma, histologically verified. Six months later a tumor was observed in the macular region of the right eye. Intensive X-ray treatment (6 series, total dosage about 900 per cent HED) was followed by arrest of the tumor growth, but later this continued, followed by perforation of the eyeball and finally death.

F CAVERS, D.Sc.

GALL BLADDER (NORMAL AND PATHOLOGIC)

Primary Carcinomas of the Gall Bladder. A R Salmon Jour Med fran^c, August, 1930, XIX, 280-286 (Reprinted from "Cancer Review" by permission.)

These tumors, which occur most frequently in women between 50 and 70 years of age, are practical-

there is a very large increase in total N. The blood non-protein N usually shows either no increase or a slight increase, but if the liver area is irradiated, there is a very significant rise. Serum Cl decreases, the extent varying with the amount of irradiation. An initial decrease in the inorganic P is followed by a marked increase. The acetone bodies increase only if the liver area is irradiated, and then in proportion to the size of the dose. A slight increase in lactic acid is followed by a decrease. All these values return to normal within twenty-four hours. Following splanchnicotomy, irradiation causes a decreased blood sugar, and does not affect lactic acid or the total acetone bodies. Vagotomy does not appreciably change the effects of irradiation. The significance of these findings is discussed.

Lymph taken from the thoracic duct of irradiated dogs and injected into rabbits does not affect the blood sugar. If the dog's splanchnics had been sectioned before irradiation, his lymph caused a marked fall in blood sugar. Presumably, irradiation stimulates the parasympathetics in such animals, releasing pancreatic hormone into the lymph and thence into the blood, explaining the fall in blood sugar observed after the irradiation of splanchnicotomized animals.

CHEMICAL ABSTRACTS

Mice as Indicators of the Presence of Carcinogenic Noxa in Factories O Teutschlaender Deutsche med Wchnschr, Dec. 19, 1930, LVI, 2166, 2167 (Reprinted from "Cancer Review" by permission.)

A wild grey mouse which was caught in a briquette factory was found to have spontaneous tar cancer, probably produced by pitch dust. This leads the author to suggest that since mice are more susceptible than men to various carcinogenic substances they might be usefully employed as test subjects in various workshops, also in the so-called cancer houses, for carcinogenic noxa (tar, aniline dyes, X-rays, etc.)

F CAVERS, D Sc

Influence of Radiation Energy on the Mineral Elements of the Blood St Malczynski, A Borysiewicz, and T Tocjyski Compt rend Soc de biol, Oct 12, 1931, CVIII, 165-167

The experiments were made on healthy dogs submitted to ultra-violet radiation from a quartz lamp, to the administration of ergosterin, irradiated by a quartz lamp, and to X-rays.

The results were that under the influence of ultra-violet radiation there was an increase of almost all the mineral elements, especially calcium and phosphorus, and to a lesser degree potassium and sodium.

The alterations resulting from X-rays were much less characteristic, especially regarding those of phosphorus, potassium, and sodium. The authors have observed a general tendency towards a lowering of these elements, for calcium, this lowering was more distinct and quite characteristic.

The effects of irradiated ergosterin were more or less similar to those of the quartz lamp, the differences consisting in greater intensity and longer duration from the quartz lamp. The effects produced by irradiated ergosterin rapidly subsided, the initial values very soon returning on the discontinuance of its administration.

The authors believe their experiments prove that ultra-violet radiation and irradiated ergosterin are stimulants, whereas X-rays have a rather slowing effect on the mineral metabolism of the healthy animal.

HENRY BAYON, MD

Experimental Investigations Concerning the Roentgenologic Demonstrability of Pulmonary Connective Tissue Oskar Meller and B Menkes Fortschr a d Geb d Röntgenstr, August, 1931, XLIV, 197-204

This is a very instructive and important paper based on the application of modern conceptions of colloidal chemistry upon our teachings of inflammation. The lungs of young children were removed from the corpses and permitted to hydrate in 5 per cent acetic acid solution. They were roentgenographed and equally inflated under identical technical conditions. There was a marked increase in pulmonary markings during the stage of hydration. It is evident that we will have to pay more attention to the mesodermic pulmonary structures in roentgenologic interpretation.

Further studies on the effects of hydration and dehydration of colloids under the influence of H and HO ions are very important for our conceptions of inflammation and its effects.

Literature may be found under the names of Bechtold, Schade, Menschel, and Roessle. Very interesting and instructive illustrations accompany this article.

HANS A JARRE, MD

Comparative Study of the Action of X-rays on the Adult Thymus and on the Embryonic Thymus A-P Dustin and Ch Gregoire Compt rend Soc de biol, Sept. 18, 1931, CVII, 1565-1567

During experiments undertaken with an altogether different purpose, in which pregnant guinea pigs were irradiated, the authors' attention was attracted by reactions of the embryonic thymus, suggesting

a filling defect in the midportion of a normal functioning gall bladder. The shape and absence of change of position suggested the roentgenologic diagnosis, which was confirmed at operation and by pathologic examination. The differential diagnosis between stones and newgrowths is touched upon.

THE AUTHOR.

Some Clinical and Experimental Studies on Cholecystography with "Colefanina" Gioacchino Nicolosi Riv di radiol e fisica med, December, 1931, IV, 231-238

The author reports his experience with oral cholecystography using "colefanina" (tetraiodophthalophenone). Good shadows of the gall bladder were obtained by this drug, which has been found to be perfectly harmless and easy to administer. The results in ten cases are reported.

E. T. LEDDY, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

The Skeleton Barium Meal in Gastric Diagnosis T D Overend. British Med Jour, Nov 21, 1931, No 3698, p 938.

It has long been customary to commence the radiologic examination of the stomach by watching the first mouthful of barium swallowed and looking for a fleck of barium held up in an ulcer niche, if this were present. If this first mouthful is spread over the interior of the stomach by palpation, a good view of the relief pattern of the mucosa is often obtained. But this procedure has its limitations. The ordinary barium meal is not perfectly adapted for the demonstration of the mucosa, and, in spite of the fact that much work has been done on the subject, it may be said that the study of the alimentary mucous membrane has not yet received the attention it deserves. Some of this neglect is due to the incompleteness of our knowledge of the great variations which may occur in the appearances of the normal relief pattern. Nevertheless, the study of the gastric mucosa is by now a valuable supplement to the usual radiologic investigation, and the method of the "thin film" or skeleton meal reveals details that cannot be otherwise discovered.

Technic—The essential preliminary is the preparation of a solution adapted for adhering to the mucosa. A useful solution is the following: 10 ounces of barium sulphate, 50 grains of tragacanth powder, made up to 20 ounces with chloroform.

water. The patient is first examined in the supine position with a slight tilt to the left, a sip of the barium is swallowed, and the cardia screened. By palpation and changes of posture the barium is spread over the mucosa and the patient examined in the prone position with graduated compression. Further sips of the barium are given until the mucosa is perfectly covered with the preparation. It is unwise to allow the procedure to become stereotyped, each case has its peculiarities which should be studied individually. The principal sites of ulcer should be screened at every possible angle and examined at different stages of filling. Films are taken when necessary. Graduated compression is required to get good relief patterns, and excessive fluid or mucus in the stomach is prevented by giving 1/100 grain atropin sulphate one hour before the examination.

Normal Appearances—A constant feature is the presence of four well-marked longitudinal ridges, visible on oblique illumination, running down the lesser curvature, these enclose the stomach path of Aschoff, which is the chief ulcer-bearing area. Towards the greater curvature the longitudinal folds become more and more tortuous, and transverse folds appear. Under normal conditions the relief pattern is delicate and easy to deform or obliterate by palpation, pathologic changes cause it to stiffen, and it then becomes permanent and cannot be altered by pressure.

Chronic Gastritis—In hypertrophic gastritis the folds of the relief pattern are thickened and stiff, in atrophic gastritis they are very delicate and may be partly absent. Great irregularity and stiffness of the folds favor the diagnosis of gastritis, and a still more trustworthy sign is the presence in the relief pattern of rounded or oval translucent islands due to patches of atrophy.

Although the diagnosis of gastritis by the skeleton meal is by no means easy or free from the possibility of error, there is little doubt but that when its normal appearances are better known it will be found more reliable than any method depending on indirect signs.

Peptic Ulcer—In the skeleton meal, as in the full meal, the direct evidence is given by the actual niche. The skeleton meal is especially well-adapted for the diagnosis of jejunal and gastro-jejunal ulcer, and also for the differentiation between ulcer and diverticulum.

Carcinoma—The skeleton meal here finds its application in determining to what extent the growth has penetrated into the stomach walls beyond the actual filling defect, and it may give valuable information as to the mechanical, as apart from the metastatic, possibilities of resection. It is also of value in the diagnosis between chronic callous ulcer and the malignant ulcer.

WALLACE D. MACKENZIE, M.D.

ly always associated with calculi (11 out of the 12 cases here reported) The author distinguishes four clinical forms, which may, however, occur in combination (1) Tumor palpable, emaciation, asthenia, dyspepsia, fever, pain, death usually from suppurative cholangitis or rupture of gall bladder and peritonitis, (2) icteric form, having, as the first and most prominent symptom, jaundice due to infection or obstruction, difficult to differentiate from carcinoma of the head of the pancreas, laparotomy frequently necessary for correct diagnosis, (3) dyspeptic form, in which gastric symptoms are prominent, while those pointing to gall-bladder disease are slight or even absent, hence early diagnosis is usually impossible (4) pseudolithiasis, here the lesion simulates gall-stone disease with biliary colic, and the rapid course is the chief feature in diagnosis of cancer In some cases X-ray examination is useful for diagnosis The prognosis is so bad that treatment is limited to relief of symptoms, indeed the chief treatment is prophylactic, i.e., removal of the gall bladder in all cases of gallstones

F CAVERS, D Sc

A New Roentgenologic Symptom of Gallstones
Béla Breuer Röntgenpraxis, Oct 1, 1931, III, 879-881

If the gall bladder does not fill with the cholecystographic contrast medium and if one sees star-shaped shadows, gallstones can be diagnosed with certainty The star-shaped shadows correspond with cavities in the stones, a fact which is known to pathologists A case is described in which the flat film showed this type of shadow, which could be seen also when the stones were roentgenographed after operation

H W HEFKE, M D

The Filling of the Gall Bladder by Contrast Material from the Stomach A M Rybak Röntgenpraxis, Sept 15, 1931, III, 844-848

The filling of the gall bladder by barium (and consequently also by food) which comes from the stomach or duodenum, does not lead to any disturbances or ascending infection of the bile ducts The roentgenologic examination of patients after a cholecystostomy or cholecystoduodenostomy is of importance for the determination of advantages and disadvantages of the several different surgical procedures At the time, one may determine the changes in the stomach and duodenum which have taken place after the anastomosis If there is a suspicion of a spontaneous fistula between the stomach or duodenum and the gall bladder (clinically severe colics which suddenly stop), the possibility of filling the gall bladder with barium must be thought of

the examination being repeated occasionally in one or two hours Although such an anastomosis has been described frequently by surgeons, the roentgenologic reports of this occurrence are not frequent,

H W HEFKE, M D

The Value of Fast Exposure Following Fluoroscopy in Cholecystography Ernst Eliasz Röntgenpraxis, Oct 1, 1931, III, 874-878

The technic of cholecystography is of very great importance for a reliable diagnosis Fluoroscopic examination of a contrast-filled gall bladder followed by an "instantaneous, aimed exposure," has been neglected It is this technic which has led to progress in the gastro-intestinal roentgenologic diagnosis An abnormal projection of the gall bladder, or its obliteration by gas in the intestines, is often very bothersome, especially if the patient lies on his abdomen for the exposure If the patient's gall bladder is observed in a standing position by use of the fluoroscope, one is almost always able to get the best possible projection Several cases have been seen, in which a gall-bladder examination of the usual type did not show stones, but the quick, aimed exposure after fluoroscopy demonstrated small stones The small cone used for this technic serves at the same time for compression.

H W HEFKE, M D

Cholecystographic Studies Olshausen Röntgenpraxis, Oct 1, 1931, III, 865-870

The author intends to show that, after determining fluoroscopically the position of the gall bladder, a very short exposure with relatively high voltage, no Bucky diaphragm, a small cone (with pressure), and standing position of the patient may give more information about the gall bladder than the usual technic in a prone position He suggests to look for the gall bladder filled by the contrast material, and if it can be seen, he advises the above technic If it cannot be seen, he employs the old technic In case of an overlying gas-filled bowel, the standing position often leads to a successful demonstration of the gall bladder

H W HEFKE, M D

The Diagnosis of Papillomas of the Gall Bladder by Means of Cholecystography Hans W Hefke Röntgenpraxis, Oct 1, 1931, III, 871-873

Only four cases of papilloma of the gall bladder, diagnosed roentgenologically and found at operation have been reported in the literature (all by Kirklin) Another case is reported, which showed

but did not change its form, except by pouring out its contents with postural changes, according to the more anterior or posterior involvement of the duodenal bulb. These large niches show no peristaltic action and cannot be evacuated by external pressure. Their contours may be entirely smooth. The mucosal structure cannot be differentiated and a relief of mucosal folds concentric to the crater is not to be observed, due to the distention of the residual not involving the mucosal surface. The proximal duodenal knee is shortened and at times so contracted that it may simulate a stenosis.

Instructive illustrations are given, especially those showing a perforated ulcer, burrowing into adjacent tissue and covered over with omentum and gall bladder.

HANS A JARRE, M.D.

Constipation G J Joubert *Jour Med Assn S Africa*, Oct 10, 1931, V, 623-628

The author discusses the problem of constipation from the standpoint of the general practitioner, giving first some of the factors in constipation with especial application to physical and mental types of persons. He states that "Constipation is one of the ailments which follows us through life, beginning in infancy."

The causes of constipation in babies are numerous: (1) Improper feeding of the mother and constipation of the mother, (2) Lack of fat in the milk, (3) Excessive evaporation of the skin, (4) Lack of regular habits, (5) Lack of muscle tone, and (6) Lack of carbohydrates.

Rectification is suggested by the additional feeding of cream or fresh butter. Castor oil or drastic purgatives are not recommended, but enemas are helpful. Fruit juice daily is beneficial, also.

Intestinal stasis in children is common and is often due to wrong diet and habits. A survey of the symptoms is made, and the diet is analyzed in detail. Regular habits are urged.

The surgical aspects of some forms of constipation are emphasized, such as relieving strictures, adhesions, piles, fistulae, etc.

The complete physical examination with the various tests and special studies are necessary in making the proper diagnosis.

In conclusion the author outlines the aims in the treatment of constipation as follows: (1) Regular bowel movement, with a formed stool, (2) Regular habits of life and food with regular and complete evacuation of the bowels, and (3) Use of a drug or drugs to promote the passage of a formed stool, and which can be used without variation.

MURRAY M COPFLAND M.D.

Lymphosarcoma of Cecum F Belcher Riforma Med, Sept 22, 1930, XLVI, 1514-1519 (Reprinted from "Cancer Review" by permission)

In a man, 22 years of age, who complained only of slight abdominal pain (unrelated to meals), a large fairly mobile mass was felt in the right appendix region. Although no localization was obtained by X-ray study after introduction of barium, operation revealed a large tumor of the cecum. This was resected and found to be a lymphosarcoma, two weeks later death occurred, with symptoms pointing to lung metastases. There was no necropsy.

F CAVERS, D.Sc.

The Form, Size, and Position of the Cecum Nicola Lovisatti *Fortschr a d Geb d Rontgenstr*, August, 1931, XLIV, 181-188

Observations were made on 2,000 cecal cases. A new classification is given as follows:

- 1 Funnel-shaped (or fetal)
- 2 Bag-shaped with bulging appendico-cecal junction in the center of the cecal pouch
- 3 Bag-shaped with cylindrical appendico-cecal junction in the center of the cecal pouch
- 4 Bag-shaped with bulging appendico-cecal junction located postero-medially and proximally within the cecal pouch
- 5 Bag-shaped with cylindrical appendico-cecal junction located postero-medially and proximally within the cecal pouch

Complete obliteration exists in from 3 to 6 per cent of all adults. Partial obliteration exists in 25 per cent of all adults (according to Ribbert).

The fourth type is found most frequently, from 55 to 60 per cent of all cases. Size and form vary physiologically in wide ranges. Rudimentary ceca, with a capacity of less than 40 c.c., occur occasionally just as macro-ceca containing up to 400 and more centimeters. A mesenterium commune occurs in from 30 to 35 per cent of the cases (according to Frommon and Treres).

The author observed 47 cases in which the cecum was found tilted dorsally and upward, with consequent abnormal insertion of the ileum. An unusually large percentage of these cases showed intestinal distress and pathology.

(*Abstractor's Note*—Comparison of these observations with the publications of Kantor in this country is suggested.)

HANS A JARRE, M.D.

Visceral Tetany Alkan Arch d mal de l'app digestif, July, 1931, XXI, 813-820

In 1922, an epileptic female, 39 years of age, pre-

Prolapse of a Gastric Polyp into the Duodenum, with Marked Secondary Anemia J W Hinton and I Buckstein Am Jour Surg, November, 1930, X, 355-357 (Reprinted from "Cancer Review" by permission)

An admirably brief and well-illustrated report (including two good photomicrographs) of a case in which a man entered the hospital for relief of anal fistula. He was very anemic and complained of no gastric symptoms. The authors very sagaciously made an X-ray examination after barium filling, and though this showed no gastric lesion it suggested a duodenal tumor. At operation this was confirmed, a stalked gastric polyp of small orange size being found prolapsed into the duodenum.

F CAVERS, D Sc.

The Roentgenologic Diagnosis of Gastro-enterostomy and Its Complications Chr Glockler-Wachramejewa Vestnic Rentgenologii i Radiologii, 1931, IX, Nos 2 and 3, p 143

The purpose of this work was to determine roentgenologically the form, position, and function of the stomach after gastro-enterostomy and the presence of any post-operative complications. Fifty-eight patients were examined, most of whom complained of some gastric disturbance. Examinations revealed that the form, position, and motility of the stomach vary a great deal. Seldom was the contour of the stomach found to be regular in outline. Adhesions and spasms were frequent complications. In a number of the cases gastric or jejunal ulcers were demonstrated.

The author believes that the position of the gastro-enterostomy is a determining factor in the development of complications. In cases in which the gastro-enterostomy was low, complications were less frequent. The roentgenologic investigation of the stomach is important in order to find out the position and form of the stomach before operation, thus enabling one to determine the most convenient place for the gastro-enterostomy. In case of no improvement the roentgenologic method is the best means of determining the character of the changes which have developed.

SAMUEL BROWN, M D

The Clinical Significance of the Roentgenologic Findings of the Stomach and Duodenum Sidney A Portis Illinois Med Jour, LXI, January, 1932, 19-23

When there is a definite discrepancy between the clinical and roentgenologic findings, both of them must be repeated and checked very carefully and the group of findings which have the most weight must be taken as the diagnosis. It is to be remem-

bered that the roentgen ray reveals facts subject to clinical interpretation and that the final diagnosis must depend upon a correlation of the roentgen and clinical findings.

High lying lesser curvature lesions are often difficult to diagnose accurately by the X-ray. These occur most often in elderly patients and are usually malignant. Since surgery offers but little relief in such cases, it is best to treat them with deep X-ray therapy, along with proper medical management.

Lesions of the greater curvature are practically always malignant and should be treated as such from the time of their recognition.

Lesions of the antrum are more open to question since this portion of the stomach is so often the site of reflex spasm. Cholecystitis, duodenal ulcer, appendicitis, and other extragastric lesions produce spasm simulating organic gastric lesions.

The clinical significance of duodenal stasis (easily recognized with the fluoroscope) is not sufficiently appreciated. Many lesions, anomalies, and anatomical conditions may produce it.

CHARLES H DEWITT, M D

Lymphatic Pseudoleukemia of Stomach, with X-ray Film of Hypertrophic Gastric Polyposis V Svab Med Klin, Dec. 24, 1930, 1922-1924 (Reprinted from "Cancer Review" by permission.)

A man, 45 years of age, had symptoms suggestive of cholecystitis, while the X-ray film resembled that of hypertrophic polyposis of nearly the whole of the stomach. At operation the stomach wall was found to be greatly thickened, while long continuous folds of hypertrophied mucosa up to 2 cm. high, ran from cardia to pylorus. The hypertrophied tissue was also enlarged neighboring glands, presented the picture of aleukemic lymphadenosis, and the blood count showed absence of leukemia.

F CAVERS, D Sc.

The Roentgenologic Appearance of the Large Duodenal Ulcer I G Brdicka. Fortschr i d Geb Röntgenstr, August, 1931, XLIV, 177-181

Duodenal ulcers, exceeding pea- or bean-size, are well known to the pathologist but rather unknown to the roentgenologist, as the literature does not contain any radiologic reference to them. The size of such ulcers is usually given as varying between pea per seed and bean dimensions.

The author reports three cases, confirmed by inspection, of very large duodenal ulcers, exceeding the size of a twenty-five cent piece. They showed on roentgenologic study a symptomatology quite different from those usually attributed to duodenal ulcer and described as follows. The crater, somewhat resembling a normal duodenal bulb, filled suddenly

"bowel." Normally, the residue of a meal should be evacuated within 48 hours, a delay of 72 hours may be considered pathological. The physiology of intestinal movements and the act of defecation are discussed. About 350 gm of semifluid chyme are said to pass the ileocecal valve daily, and about 135 gm of feces are passed daily.

The etiology of constipation is discussed and the causes, according to Kast, are listed as follows:

(1) Mechanical obstacles, due to (a) external pressure from abdominal or pelvic tumors, (b) invaginations, volvulus, kinks from adhesions, (c) stenosis of intestines from ulcers, etc., (2) Dyschesia (fissure, hemorrhoids, etc., inhibiting reflex), (3) Inhibiting influences such as spinal disease, abdominal inflammations, endocrine dysfunctions, psychic depressions, (4) Functional derangements, such as toxic disturbances, tone of intestinal musculature, abnormal lack of stimulation, (5) Essential constipation.

The author considers dyschesia as the most common type. Essential constipation is considered to be due partly to defect in mechanism of peristalsis and to endocrine defects.

Under "Clinical Investigations," the author states that sufficient information is often obtained from an ordinary history and clinical examination. Examination of the anus and rectal examination prevent many errors. Other adjuncts to the physical examination are proctoscopic examination, chemical and microscopic examination. An X-ray of the gastro-intestinal tract often gives a clue to the origin of the constipation.

The symptoms and effects of constipation are discussed under the head of headaches, vertigo, insomnia, and fatigue. Digestive disturbances are not infrequent, including flatulence, abdominal discomfort, and offensive breath. Gastritis and duodenal catarrh may supervene. Palpitation, dyspnea and low blood pressure are sometimes noted.

The author discusses the treatment of constipation at length, the essentials of which are (1) Correct diagnosis, (2) strengthening and educating the bowel, (3) removing the cause where indicated and possible (appendix, etc.), (4) regard for diet, and (5) combinations of dietetic, local, and drug treatment.

The diet of the tonic case should contain large quantities of cellulose, increasing the bulk of stools. The spastic constipation case should have food which leaves as little residue as possible.

Enemas are suggested as relief and are discussed in detail. Among the drugs which are mentioned agar agar and mineral oil are considered as important. The vegetable drugs are recorded with dosage and effects on bowel. Salines by mouth are emphasized in certain types of cases. "Mercurial purgatives should be reserved for special occasions," the author states. They do not have action on the

flow of bile. Opium is often used in combination, with cases of colitis.

Some foods have laxative effects (brown sugar, honey, sour milk).

Hormones are discussed. Thyroid extract is considered helpful in cases of sub-thyroid individuals.

The surgical aspects of constipation are not dealt with.

MURRAY M. COPELAND, M.D.

The Diagnosis and the Cure in Gastroduodenal Ulcers, Clinically, Radiologically and by the Gastroscope François Moutier. Arch. d. mal. de l'app. digestif, July, 1931, XXI, 821-832.

There are few questions so delicate to approach as the interpretation of the cure of gastroduodenal ulcers, in spite of the numerous publications of new methods of treatment and rapid cures following each method.

Clinically, the disappearance of pain, hematemesis, melena, and vomiting signifies nothing. It means simply the disappearance of the paroxysm. Anatomically, these ulcers, it is true, may heal rapidly, even in a few weeks, with cicatrization. Many relapse after weeks, months, or years. The intermediate silence does not signify cicatrization. They have, therefore, an evolution, intermittent and spontaneous. Absolute negative clinical or radiologic findings may be observed between attacks, although in general, untreated cases seldom present longer absence of symptoms than one year, while treated cases have been known to have time intervals of over two years. Some cases may have ulcers arising in other areas, following the original involvement.

Radiologically, the disappearance of the niche does not mean a cure. The image seen often represents an ulcer plus something else. Many flat ulcers present such a niche and the actual measurement of the ulcer may vary considerably from that of the X-ray image. Another factor to be explained is the disappearance of this niche sometimes in two or three days or longer. Agreeing with Schindler, Gutzeit, Haudek, Forssell, Berg, and Albrecht that inflammatory and dynamic conditions are present, there are still other factors in evidence. Besides the edema of the borders of the ulcer and inflammatory interstitial reaction, there is a swelling of the adjacent folds, forming around it a pouch and even excluding the ulcer from the gastric cavity in the form of diverticula. Dynamically varying spasms or contractions are present, or are seen by the gistroscope. Such may be like a diaphragm, a purse, or a buccal contraction, forming a separate cavity at the bottom of which lies the ulcer. A film so viewed gives the image of a semicircle which in reality is a trough-like depression. Relief of the surrounding inflammation and spasm is followed by

sented, besides several daily attacks of epilepsy, cramps in the upper abdomen, accompanied by vomiting, which occurred as often as six times daily. In addition, there were symptoms of tetany, particularly Troussseau's phenomenon. Radiology revealed spasm of the antrum only. Within twenty-four hours all spasm had disappeared after injections of paraglandol, an extract of the parathyroid gland.

Carlson and Jacobson produced tetany in nineteen out of twenty-three dogs, after parathyroidectomy, as well as hyperemia and small hemorrhages of the gastro-intestinal mucosa, particularly in the pylorus and the duodenum. Ulcers of variable size were also found in these areas.

Clinical confirmation is found in the report of Falta and Cahn, who, in 1912, reported that ten out of twenty-one cases of idiopathic tetany presented gastro-intestinal spasms and hypersecretion, while three had definite ulcers.

One case is described of a white woman, presenting such symptoms after accidental parathyroidectomy, accompanied by X-ray plates showing spasm of the antrum and pylorus and an ulcer of the antrum.

In 1929, the author published a report of 220 cases showing hypermobility or spasm of the digestive tract, with hypersecretion and with or without ulcers. Of this number, forty-six, or 23 per cent, showed Chvostec's or Troussseau's signs.

The author concludes that these ulcer cases, presenting symptoms and evidence of hypoparathyroid function, are caused by this deficiency. Erosion of the mucosa occurs frequently and is a transient affair, but when this occurs in a mucosa where the mobility is greatly increased and at times exaggerated to such an extent that spasms occur, there takes place a repeated and prolonged anemia around the erosion. Autodigestion by the gastric juice may follow and in this manner a chronic ulcer is formed and persists.

In 148 cases of tetany, he found 66, or 45 per cent, with ulcers. Twenty showed only hypermobility of the antrum. All these cases presented a spasticity of the descending colon, which he believes occurs in all such ulcer cases, due to tetany.

Following the subcutaneous administration of paraglandol and intravenous injections of calcium chloride or bromide, the author had success in three-fourths of these cases, while no results were obtained in ulcers due to other causes. In 65 cases, 54 per cent are well after one year and 31 per cent are well after more than two years. At times parathormone (Collip) was used in very refractive cases. A regime of bland, non-irritating food, without meat, is followed in severe cases. The therapy is favored by the periodicity of the function of the parathyroid gland with its normal summit in spring and autumn. Even in cases apparently well, several injections of calcium are given at the beginning of the perilous seasons.

B. J. DELAUREAL, M.D.

GASTRO-INTESTINAL TRACT (THERAPY)

New Research on the Treatment of Gastro-duodenal Ulcers by Parathyroid Extract. François Moutier and Louis Camus. Arch. d. mal. de l'app. digestif, July, 1931, XXI, 834-848.

Since the original publication, in 1929, Hernando Rocha, of Madrid, and Gallart y Mones, of Barcelona, have reported discouraging results, while Max und Ernst Levy have obtained purely negative results from this type of therapy. Statistically, this has no advantages over other forms of treatment. However, the authors still feel that it has its indications. Forty-five cases so treated are analyzed. Eight cases, or 17 per cent, gave absolutely negative results. Of these, three were intolerant of the drug. Twenty cases were improved both as to clinical and radiologic manifestations. Seventeen cases had relapses.

The extract can be given hypodermically or by mouth, the latter method being preferred. Ten units of parathormone Lilly represents 1 c.c. of parathyroidine Byla. Small doses are preferable and in cases in which there is evidence of intolerance, such as vomiting or exacerbation of pains, the drug should be given at an interval of from 2 to 3 days. Hypercalcemia is a contra-indication. This form of therapy can be combined with others, as bismuth, atropine, pepsin, and insulin. No benefit was observed when calcium was added to the treatment. Vagotonia types tolerate the drug better. Often the relief of pain is immediate, at other times following two or three injections. Nocturnal pain disappears first. Occasionally a rapid fall in acidity occurs. The most favorable cases are those without stenosis, periduodenitis, or perigastritis. The blood-calcium content is but slightly affected. Those cases with an acid-base equilibrium tending towards the acid side seem to react most favorably. It is also most effective in the younger individuals.

Observations on four cases show the variations of response to different treatments. Each case responded to one of the following treatments after failure of all the other types mentioned: parathyroid, pepsin, atropine, and insulin.

After five years' study the conclusion is drawn that parathyroid extract has a definite, but irregular and mysterious, action which needs further study.

B. J. DELAUREAL, M.D.

Constipation. S. F. Silberbauer. Jour. Med. Assn. S. Africa, Oct. 10, 1931, V, 619-623.

The author defines constipation as "a disturbance of intestinal function, usually of the colon, which results in delayed or incomplete evacuation of the

Over-exposures lead to false diagnoses. On the other hand, a perfect film without evidence of the shadow of a stone is not proof of the non-existence of a stone, as 30 per cent of stones do not cast shadows. Phleboliths often mislead one as to the diagnosis of stones in the ureter, a point which can be easily decided by taking another film in another plane. The use of contrast fluids, by either the descending or ascending method, offers also many pitfalls in the diagnosis. The filling defect in uroselectan films is not as valuable for the diagnosis of tumor as that of contrast filling on a pyelogram. Uroselectan is useless for diagnosis of stones, and still more problematical is it in the functional diagnosis. Only an expert can interpret these films. The same holds true in the diagnosis of pathologic conditions of the ureters in pyelograms. Diagnoses of enlargement of the pelvis of the kidney, and stenosis or kinks of the ureter are made far too frequently.

E. A. MAY, M.D.

The Diagnosis of Ureteral Calculi and the Problem of Their Conservative Management. Albert M. Crance. *Am Jour Surg*, January, 1932, XV, 120-129

A series of seventy-seven cases of ureteral calculi is reported, in which three, or 3.89 per cent, required ureterolithotomy, two are still unpassed, and seventy-two, or 92.5 per cent were passed successfully without open operation. In this series, it is interesting to note that fifty-seven, or 74 per cent, showed rather definite roentgenographic shadows of the calculi prior to the filling of the ureter with an opaque solution. The X-ray technic in ureteral stones must be most carefully considered. One must study his roentgenographic findings with great care. Many calculi are missed by too quickly passing a negative opinion on a film in which the stone shadow may be discovered later.

Diagnostic importance is made of the clinical history, the presence of red blood cells in the urine, and the cystoscopic and X-ray technic combined. Cystoscopy is planned, preferably while there is still renal tenderness present. The ureteral catheter or bougie is more apt to meet obstruction at this time, at the point where the stone is lodged. The finding of pelvic retention by syringe test is also of importance at such a time.

If a catheter is passed after the relief of colic, it may occasionally go beyond a stone without the slightest sense of obstruction. However, the technic of passing a catheter should be carried out slowly and cautiously. Rapidity in reaching the renal pelvis loses all the fineness of touch and sensation. If one catheter has passed up successfully, then, and not until then, is an exposure made on a 14 X 17 inch film, using, of course, a Potter-Bucky diaphragm.

The operator may then attempt to pass another No 5 catheter. In a few instances, a second catheter has met obstruction at the stone, but in most cases two have been admitted successfully. The X-ray film should then be studied by the operator. If a shadow is demonstrable, one of the two catheters is plugged and a urogram made; however, this is not always necessary. The degree of hydronephrosis can often be ascertained by withdrawing the residual pelvic urine by means of a syringe. If no shadow is found and there is no reason to suspect a stone, the catheter is removed and replaced with a larger Garceau or Woodruff catheter for the purpose of urography. Filling defects, bulging in the ureteral wall, plus the previous findings of red cells, may be regarded as indicative of ureteral calculi.

A diagnosis having been made, two No 5's are again passed up beyond the stone. No doubt there are some who will say, "Supposing the stone cannot be passed, will the ureter allow a catheter?" Then a heavy No 8 or 9 olive-tipped bougie usually will pass. If one then attempts to introduce a catheter immediately after the removal of a bougie, it will almost always pass. It may be necessary to draw it back and forth a few times, which, incidentally, has been of great value.

The patient is then returned to his room in a recumbent position, and the catheters left in place for twenty-four, forty-eight, or even seventy-two hours. As the catheters are about to be withdrawn, one is plugged (if two are in) and a 30 c.c. Luer syringe is filled with sterile water and connected to the catheter. The kidney is filled slightly beyond the point when the patient feels the renal pressure. The catheter is very slowly withdrawn with one hand, while the syringe is held for injection in the other hand. Two forces are at work with this procedure—the traction caused by the downward motion of the catheter, plus the force from above, which in many instances accomplishes the desired purpose. Frequently, by this procedure, patients have passed calculi within forty-eight hours after the removal of the ureteral catheters, and in most instances without any additional, or so-called "final colic." This method of removing the ureteral catheters during irrigation has resulted rather successfully in a rather high percentage of cases.

The use of ureteral spirals, forceps, rubber-bags, etc., has in no way added to the successful management of this series.

No mortalities occurred in this series.

Several interesting plates of ureteral calculi accompany the article.

DAVIS H. PARDOLL, M.D.

Urethrography with Abrodil as Contrast Fluid
B. H. U. Mohrmann and Heinz Strauss. *München med Wehrnschr*, Oct 2, 1931, LXXVIII 1700-1702

a disappearance of the niche, any new muscular excitation causing its reappearance. This, of course, holds true for only gastric cases. Occasionally the image of a cavity can be seen without, or in an area away from, an ulcer.

In old and callous ulcers, the X-ray cavity may represent its true size, and its disappearance may signify healing. Also, it is possible that the fibrous exudative covering may be brushed off and followed by a reappearance of the niche.

These facts have been established from endoscopic studies. Here ulcers were found which caused no X-ray shadows, others which were very flat but which caused a shadow, still others which were detached from the general gastric cavity by spasm. Gastroscopy and gastrophotography allow one to watch the progress of healing after the X-ray findings are negative, following the suppression of spasm.

A silence of at least two years and possibly three should elapse before one can consider an ulcer cured.

B J DELAUREAL, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

Recent Advances in Diagnostic Methods in Renal Affections R Ogier Ward British Med Jour, Aug 1, 1931, No 3682, pp 175-177

The first diagnosis of stone by X-rays was made in 1896. Then, in 1906, Voelcker and Von Lichtenberg established instrumental pyelography as a diagnostic method. Von Lichtenberg has now developed excretion urography to its present high efficiency by the use of the pyridine derivative, Uroselectan, first produced by Binz and Raeth. Many other chemical compounds have been tried, but the latest and most successful is D-40, better known as Uroselectan B. It is another pyridine derivative containing 51 per cent iodine as compared with the 42 per cent in its predecessor. It has been produced by the same chemists and tested in Von Lichtenberg's clinic. It is interesting to note that a large amount of iodine is not essential, as only 15 grams of Uroselectan B are used for each injection, compared with 40 grams of the original Uroselectan. The special success of Uroselectan B is due chiefly to the fact that the kidneys eliminate it very promptly (a quarter of an hour) in the urine in high concentration and with a diuresis which is just sufficient to cause it to flow through the urinary tract in an intensity suitable for X-ray work.

The technic of injection is as follows. Uroselectan B is sold as sterile solution in 20 c.c. ampules which contain 15 grams of iodine compound. The dose used for adults. The solution is warmed

to body temperature and injected intravenously with a 20 c.c. syringe. There is no need to inject the solution slowly.

Contra-indications and precautions. Uroselectan B produces no discomfort and is entirely non-toxic. Uremia, either present or impending, is the chief contra-indication and, therefore, a routine blood urea and kidney function test is necessary to exclude this. If any serious general illness co-exists, special caution should be exercised. Due to the inefficiency of the kidneys the liver undertakes in part, at least, the excretion of the drug, therefore, liver disease is a contra-indication. In acute inflammation of the urinary tract excretion urography must be avoided. Iodine idiosyncrasy rarely manifests itself.

One of the most interesting results brought about by this new method of investigation is the fresh light shed upon the neuromuscular mechanisms of the urinary tract. Therefore, it will help us much in the study of the pathology and treatment of hydronephrosis. This disease is the result of a defect in this mechanism, the law which governs the working of a system of unstriped muscle has broken down, contraction occurs in one segment but no relaxation in the segment below, probably owing to the disturbance of sympathetic control. A pyelogram demonstrates clearly a hydronephrosis. Excretion urography sometimes shows the same hydronephrosis but of considerably larger size. This is because in the latter case the kidney has filled the pelvis at a rate to which it is accustomed, whereas in instrumental pyelography the opaque fluid has been run in through the ureteric catheter much more rapidly, and the pelvis has resisted the process. This gives us a clear proof that, though damaged, the pelvic neuromuscular mechanism is not destroyed, and this is an encouragement to the surgeon who wishes to perform upon it a plastic operation.

There are certain conditions in which excretion urography is of special value for other reasons, namely, when it is undesirable or impossible to pass the cystoscope, as, for example, in the presence of a urethral stricture or an enlarged prostate, or severe cystitis. And, again, in circumstances preventing the passage of a ureteric catheter, such as ureteric kink, or a ureteric calculus.

WALLACE D MACKENZIE, M.D.

Mistakes and Pitfalls in the Examination and Treatment of Diseases of the Uropoietic System Eduard Pflaumer München. med. Wchnschr., Sept. 25, 1931, LXXVIII, 1654-1657

This article is written for the general practitioner as well as for the specialist. It illuminates the subject from every angle, not in the least from that of the X-ray specialist. The most important technical mistakes are those of incomplete photography of all uropoietic organs and of unsatisfactory plates.

Over-exposures lead to false diagnoses. On the other hand, a perfect film without evidence of the shadow of a stone is not proof of the non-existence of a stone, as 30 per cent of stones do not cast shadows. Phleboliths often mislead one as to the diagnosis of stones in the ureter, a point which can be easily decided by taking another film in another plane. The use of contrast fluids, by either the descending or ascending method, offers also many pitfalls in the diagnosis. The filling defect in uroselectan films is not as valuable for the diagnosis of tumor as that of contrast filling on a pyelogram. Uroselectan is useless for diagnosis of stones, and still more problematical is it in the functional diagnosis. Only an expert can interpret these films. The same holds true in the diagnosis of pathologic conditions of the ureters in pyelograms. Diagnoses of enlargement of the pelvis of the kidney, and stenosis or kinks of the ureter are made far too frequently.

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DAVIS H. PARDOLL, M.D.

Urethrography with Abrodil as Contrast Fluid
B. H. U. Mohrmann and Heinz Strauss Münchener Wochenschr., Oct 2, 1931, LXXVIII 1700-1702.

The injection of contrast fluids in the male urethra for X-ray diagnosis has been done since 1910. It can be used in cases of acute gonorrhea, and shows, by means of the X-ray, early as well as advanced strictures. It demonstrates the condition of the urethra beyond the stricture, also diverticular abscess cavities and injuries. It is ideal as a follow-up examination, the technic being simple. From 20 to 50 c.c. of abrodil are injected into the urethra. The patient lies on his back in a semi-oblique position, with the penis parallel to the leg.

E A MAY, MD

Excretion Pyelography (Urography) by Means of Subcutaneous Abrodil Infusion O Butzengerger Röntgenpraxis, Oct. 1, 1931, III, 881-884

Excretion pyelography has proved itself a very valuable diagnostic means, being often the only possible means for a roentgenologic diagnosis of kidney diseases. Intravenous injection of the contrast material has been the only means of getting a good pyelogram. It is, however, not always technically easy and even occasionally impossible (children, fat persons). The author has endeavored to present a subcutaneous method of introducing the abrodil (skiodan in the United States). In association with Hecht, the discoverer of abrodil, the method was worked out. A 4 per cent sterile abrodil solution, which is practically isotonic, is used and two ampules of impletol (a combination of caffeine and novocaine) are added. If 20 gm of abrodil are to be used, 500 c.c. of this solution are injected subcutaneously between the breast and axilla.

After using this method in thirty cases the author came to the following conclusions. The best roentgenograms are obtained from 30 to 50 minutes after completing the injection, but good roentgenograms are still given from 1 to 2 hours afterwards. Skin damage or necroses were not observed. No general reaction took place. In a few cases some slight pain was complained of during the injection. In all thirty cases the demonstration of the urinary tract was satisfactory. This method seems indicated especially in children.

HANS W HEFKE, MD

GENITO-URINARY TRACT (THERAPY)

Transplantation of Ureters to Rectosigmoid and Cystectomy for Exstrophy of Bladder Report of Seventy-six Cases Waltman Walters Am Jour Surg, January, 1932, XV, 15-22

The results obtained in transplantation of ureters to the rectosigmoid and removal of the exstrophied bladder in a group of seventy-six patients operated

on at the Mayo Clinic are reported. The method of transplantations was first used by C H Mayo in February, 1912, he applied Coffey's principle of submucous duct transplantation to the ureter. The operative procedures have been divided into three stages (1) Transplantation of the right ureter into the rectosigmoid, (2) two weeks later transplantation of the left ureter, and (3) ten days later removal of the exstrophied bladder. In none of these cases were ureteral catheters used in the transplantation. Three patients died in the hospital subsequent to operation. Twenty-seven patients have lived five years since the operation, and thirteen have lived ten years. Results were unsatisfactory in only three cases. In 50 per cent of the cases there was no evidence of renal infection. In 21 per cent there were short periods of mild renal infection, the interval between such periods in most cases being many months, sometimes years. The infection, too, was mild and apparently had little effect on the patient. The use of compounds such as uroselectan, or skiodan, intravenously, has made possible the study of renal function as well as of the outline of the renal pelvis and ureter in many of these cases. The use of this method and other methods of study of renal function leads to the belief that renal function is normal and that there is no dilatation of the pelvis, calices, or ureters in cases in which the uretero-sigmoidal transplantation is accurately carried out.

Several uretero pyelograms taken before and after operation for exstrophy of the bladder accompany the article.

DAVIS H PARDOLL, MD

Ureter Catheter Drainage in Ureterotomy W M Kearns and S M Turkeltaub Am Jour Surg, January, 1932, XV, 56-60

The author presents a case record which demonstrates the consequences of omitting catheter drainage. The indwelling catheter has a distinct place in ureteral surgery because it insures kidney drainage, eliminates fistula and urinary extravasation by diverting the stream, promotes prompt healing, and prevents stricture formation. It may also act as a prophylactic against suppression of urine.

In the case cited by the writers, attempts to pass a ureteral catheter at operation, following ureterolithotomy, were unsuccessful. The rubber drain was removed from the ureteral bed twenty-four hours following operation. This early removal was carried out with the hope that the urine would make its way through the lower ureter promptly instead of through the fistula, thus obviating ureteral obliteration. The urine continued to extravasate and the fistulous tract closed, with the development of symptoms of sepsis, urinary absorption, and anuria. Blood transfusion overcame the anuria in a phenomenal

way The symptoms of sepsis and urinary absorption were miraculously relieved by the passage of a ureteral catheter

Several roentgenograms illustrative of calculus in the ureter and extravasation of the pyelographic media accompany the article

DAVIS H PARDOLL, MD

Endothelioma of Penis Urethrography W Dobrzaniecki Jour d'Urol, April, 1930, XXIX, 368-377 (Reprinted from "Cancer Review" by permission)

In a man 59 years of age, complaining of burning pain on micturition, examination showed escape of somewhat purulent liquid on compressing the penile urethra, infiltration of glans, slight soft enlargement of inguinal glands, and a hard, enlarged prostate. Tumor was suspected and its site accurately determined by urethrography, using a contrast material 100 c.c. of barium suspension mixed with 10 c.c. of 2 per cent collargol solution. The penis was amputated in its upper third and the inguinal glands dissected out. The microscopic diagnosis was hemangio-endothelioma. There was no sign of recurrence when seen four months later

F CAVERS, D Sc

GYNECOLOGY AND OBSTETRICS

Anatomic Changes Subsequent to the Radiotherapeutic Treatment of Benign Uterine Conditions James A Corsaden Am Jour Obst and Gynecol, July, 1931, XXII, 74-86

The author analyzes 434 cases with reference to the effect of irradiation on the size of the myomatous uterus, the importance of X-ray and radium as excitants of latent infections, the frequency and importance of subsequent changes within the tumor, such as degeneration and sarcoma, the occurrence of carcinoma of the body and neck of the uterus and disease of the tubes and ovaries, especially those conditions which were overlooked at the time the treatment was given and later became apparent.

In the literature, considerable emphasis is placed upon the danger of exciting quiescent foci of infection by radium and X-ray. Many such cases are reported, but the precise lesion is less often described. The author, a gynecologist, and presumably impartial toward irradiation, concluded that the cause of inflammation following the introduction of radium was due to an operative contamination rather than to some less obvious effect of the electromagnetic waves upon either the tissues or bacteria in a residual inflammatory focus. In fact, several cases in which there was definite inflammation showed improvement following roentgeno-

therapy. Polak and Bal, who have had similar experiences, employ the X-ray as a therapeutic measure in the management of acute pelvic inflammatory disease.

In all patients treated for uterine myomas, the growth was stopped, reduction has occurred to a satisfactory degree in 83 per cent, and there has been complete reduction of the mass to the size of a normal uterus in 55.2 per cent.

The author, basing his statement on the government mortality statistics, states that 2.4 per cent of women in general develop carcinoma of the uterus. Only 1.28 per cent of his cases treated for fibromyomas subsequently developed carcinoma of the uterus, observations having been over a period of seven years.

The evidence permits the author to conclude that the incidence of diseases in the organs of reproduction of women after treatment by X-ray and radium is a little less than in women in general. The occurrence of uterine bleeding and discovery of a small myoma does not make one a candidate for promiscuous prophylactic excision. With the growth stopped and the uterus made smaller by X-ray or radium, she has the same chance for health as the women without these conditions.

The importance of a diagnostic curettage is emphasized. The author encountered unexpected pathology (carcinoma of the body of the uterus, epithelioma of the cervix, pedunculated intra-uterine myomas, polyp) in 3 per cent of his cases, which caused a change in the method of treatment.

JACOB H VASTINE, MD

Myoma of the Uterus E Vogt München med. Wochenschr, Sept 4, 1931, Vol 78, No 36, pp 1525-1529. Also issue of Sept 11, 1931, 1562-1565

The author deals with symptomatology and diagnosis minutely. He compiles the different types of treatment and gives the indications for each, which do not, in any way, deviate from the methods used in this country.

E A MAY, MD

Significant Problems for the Obstetrician in the Field of Mammary Cancer B J Lee Am Jour Obst and Gynec, December, 1930, XX, 775-781 (Reprinted from "Cancer Review" by permission)

Out of 306 cases of breast cancer in women under 40 years of age eleven were pregnant. The longest period of survival after operation was five years and ten months. In such cases the pregnancy should be terminated, the radical breast operation done directly afterwards, and the patient advised to undergo

ovarian sterilization by high-voltage X-rays, or if not consenting to this measure, to avoid further pregnancy. In fourteen of these 306 patients, the breast cancer co-existed with the puerperium, and the results of operation were not much better in this group. Out of 1,827 patients seen at the Memorial Hospital with breast cancer, eleven had a malignant tumor of the genital organs (cervical cancer, corporeal cancer, 4; vulva and ovary one each).

F. CAVERS, D.Sc.

Actinotherapy in Gynecology Jose Luis Molinari
Rev. Med. Cubana, November, 1931, XLII, 1338-1358

In this article the author not only discusses actinotherapy as it applies to gynecology but gives complete and comprehensive information on the entire subject of actinotherapy. At the beginning of the article he limits his discussion to ultra-violet ray therapy, leaving the discussion of infra-red rays for a future date.

After defining the terms which will be used, the author goes on to describe the place occupied by the ultra-violet rays in the spectrum. This is followed by the list of physical and chemical properties of these rays. After describing the Herz-Hallwachs' phenomenon, the intensity of the rays is taken up. He points out the various intensities which will produce different physiologic changes. Using different Angströms, diverse physiologic reactions are produced. In this connection the author makes mention of the results obtained by Nogier and d'Hasselbach and Macht and Bells.

The discussion continues with the physiologic and biophysiologic reaction produced by the ultra-violet rays. In this connection we may list some of the most important bactericidal action and metabolic action on calcium, phosphorus, sulphur, sodium chloride, and the general action on protoplasm. In the consideration of the action of ultra-violet rays on the human organism the author takes up the effect on the integument. Erythema, being the most important, is taken up first. The author presents Finsen's conclusions, which are as follows: (1) The thermic rays produce only a temporary erythema lasting about two hours; (2) ultra-violet rays produce an erythema which is late in appearing but lasts long; (3) the rays next to the ultra-violet rays also produce an erythema but it is less lasting.

In the author's opinion most physiotherapists prefer to use from 2,970 to 2,800 Angströms to produce an erythema. Using this amount, the erythema appears in from four to six hours, this naturally varying with the cutaneous sensibility of the various body regions. According to Hill, Elinart, Kisch, and Sobodka, erythema is produced more quickly and to a more intense degree when the integument has

been heated previously. The erythema varies with the individual, age, and certain diseases, such as asthma, adenopathies, hepatitis, and hyperthyroidism.

The duration of the erythema varies from forty-eight hours to a week. The redness changes to violet and later to maroon. This is a sign of the beginning of pigmentation, the mechanism of which is not exactly known at present. Turning to physiologic chemistry for information one has to consider the skin as a gland as well as a protective covering. Chemical analysis has shown that there are various diastases present in the skin. The following have been isolated: amylase, lipase, catalase, phosphatase, sulphatase, carboxylase, oxidase, a peptolytic ferment, and tyrosin ferment. Thus, it is reasonable to assume that through oxidation and reduction processes on the diastases, ultra-violet rays cause pigmentation. Keratotic changes of the skin take place when the pigmentation disappears, however, these changes occur simultaneously with pigmentation but independent from it. According to the studies of Lederle, Pautrier, Magnus, Müller, etc., the following take place: (1) The most superficial layers of the skin show intracellular and intercellular edema. (2) The blood vessels in the dermis are engorged and show a lymphocytic infiltration.

The author here gives a complete report of the ultra-violet rays on the following organs and tissues: the eye, blood, nervous system, spleen, suprarenals, thyroid, ovaries, and bones. He continues by giving a discussion of the various theories on the general action of ultra-violet rays. Of these the following workers and their theories are mentioned: Christen (1917-1919), S. Rothmann (1924, 1925), and Rohler. The two theories best recognized are those of Keller and Guillaume. Keller believes that the reactions produced by ultra-violet rays are due to a toxic effect caused by the reabsorption of by-products, which are the results of the irradiation. Guillaume takes up Keller's theory and adds more detail to it. Vignal, on the other hand, does not accept either theory because neither one is based on chemistry, physics, or biology. He thinks that the changes are produced by oxidation-reduction processes.

In discussing the artificial supply of ultra-violet rays, the author mentions the voltaic arc, the mercury lamp, and the specially named lamps, such as Walter's and Landeker's.

For the determination of ultra-violet doses many methods have been proposed, the most important of which are enumerated:

(1) *Photo-thermic*—This is based on the transformation of light into heat. The apparatus used is the "pireliometro" of Pouillet and the "pilatermo-electrica" of Melloni.

(2) *Photo-chemical*—This is based on the chemical actions of the ultra-violet rays. Keller's apparatus is used for this measurement.

(3) *Photo-electric*—If light falls on a film immersed in a conducting liquid, a current is produced.

which goes over to another film kept in darkness The apparatus of Mallet and Chquet is used

Since the skin sensibility varies with the individual, it is best to determine this sensibility, using either Keller's or Saidman's apparatus With the latter apparatus one can determine the various stages of erythema from its formation to its hemorrhagic stage.

In the discussion of gynecologic conditions the treatment is taken up in anatomic order from the outer to the inner structures

Affections of the Vulva—Schlein thinks that actinotherapy is of no value in the treatment of pruritus Using the technic of Aimard and Dausset, that is, local and general applications of ultra-violet rays, giving an erythema dose from time to time, good results are obtained A local erythema dose is given two or three times a week If necessary, small doses of X-ray are given The above named authors have obtained good results using the technic outlined In fact, they report improvement even in difficult cases, having given them twelve applications The use of the high frequency current has also given favorable results Other vulvar conditions treated successfully are eczema, fissures, vulvitis, and kraurosis (using the X-ray) Fissures due to bartholinitis heal very quickly under ultra-violet-ray treatment

Vaginal Affections—Wagner began the treatment of vaginitis in 1913 Later, Lang reported good results The latter gives his results in the treatment of both children and adults The therapy consists of both local and general irradiation He begins with exposures of five minutes each

Cervical Lesions—Non-cancerous lesions of the cervix respond remarkably well to ultra-violet irradiation Wagner, Van de Velde, and Mateucci have obtained satisfactory results with six exposures In cases of cervical discharge ultra-violet irradiation has proved of inestimable value Complete cures have been obtained in 51.3 per cent of the cases Using the Landeker lamp, applications may be given for as long as thirty minutes at a time Complete cures have been obtained with from three to eight applications Even the chronic cervical lesions have responded to this treatment The lesions due to inflammatory causes respond quicker than those due to other causes

Lesions of the Corpus Uteri—Wagner thinks that ultra-violet-ray treatment will control uterine hemorrhage due to fibroids In sclerosis of the corpus uteri, Francillon-Lobre and Palisse have obtained good results Landeker has obtained 60 per cent cures in chronic endometritis Casati, Viana, and Mateucci also report satisfactory results Local applications are given by means of the speculum of Ferguson or by a quartz lamp applicator in doses of from six to ten minutes' duration

Lesions of the adnexa and parametritis have also been treated with good results Pyosalpinx has been

treated by a combination of abdominal and general ultra-violet irradiation The parametritis cases have required long applications but even cases due to gonococcal infection have subsided Inflammatory masses, especially those due to gonococcal origin, have responded remarkably well to ultra-violet treatment Those reporting cases of this nature give 70 per cent cures Salpingitis also responds with the same favorable results

In the treatment of ovarian disorders ultra-violet rays have demonstrated the following That (1) menstruation is stimulated in the young, (2) the menstrual flow is regulated, and (3) the menopause is retarded.

Hypoplasia—Landeker has reported ten cases of delayed ovarian function due to congenital deformity which improved under ultra-violet irradiation In the treatment of ovarian disorders as amenorrhea, the condition shows quick improvement This is especially true of those cases due to ovarian insufficiency The ultra-violet rays have no direct action on the uterus but accelerate the ovarian tissue Aimard and Dausset give local and general irradiation using both sunlight and ultra-violet light After twenty exposures most cases show improvement. Dysmenorrhea and oligomenorrhea respond to ultra-violet treatment by improvement of the condition Scanty menstruation is improved and dysmenorrhea is practically corrected In cases of premature menopause, especially those due to X-ray exposures, satisfactory results are obtained The symptoms of menopause disappear, and the patient feels relieved The internal ovarian secretion is accelerated under ultra-violet irradiation These internal secretions stimulate the secondary sexual characteristics

Genital Hemorrhage—Ultra-violet irradiation is particularly indicated in the following (1) Juvenile hemorrhages, (2) pre-climacteric and climacteric hemorrhages, and (3) hemorrhages due to secondary anemias

Genital Tuberculosis Including the Adnæa and Peritoneum—In treating genital tuberculosis, one aims to give the patient a supportive treatment as well as to produce a local hyperemia The technic used is as follows (1) Gradual increase of doses of sunlight treatment, (2) local ultra-violet irradiation combined with sunlight exposures, (3) general increase of ultra-violet irradiations, (4) abdominal applications of ultra-violet rays from time to time, and (5) combination of ultra-violet and X-ray therapy

Most of the cases with ascites show improvement Those cases having perivisceritis or pericolitis show an acceleration of the symptoms On the whole the majority of cases of genital tuberculosis shows improvement

Ultra-violet rays in gynecology give the following (1) A local action, as in dermatology, on eczema, abscess, etc., (2) a general action, especially on

tuberculosis and anemia, and (3) a direct action on the ovary

JOSEPH MALDONADO, M.D.

Unusual Tumor of the Nipple. E. Fischel and L H Jorstad Am Jour Surg, January, 1931, XI, 121-124 (Reprinted from "Cancer Review" by permission)

The patient, a woman of 27 years, said she had had a wart on the nipple for seven years, which had not been influenced by electrodesiccation or X-ray treatment. The growth was reddish brown and measured 3 X 2 millimeters. The nipple and the surrounding normal areolar tissue were excised and examined microscopically, good photomicrographs being given. The chief features of the lesion are hyperplasia and keratosis of the epithelium, with inflammatory changes in the surrounding tissue. It seems to be an atypical early Paget lesion.

F. CAVERS, D.Sc.

Radio-active Modifications in Ovarian Insufficiency Iribarne Bruxelles-Med, Sept. 13, 1931, XII, 1336, 1337

After presenting new ideas concerning ovarian insufficiency and its different clinical types, together with results of his own experience, the author is convinced of the stimulating action of radio-active substances on cellular activity, especially when small doses are employed. Parallel experiments have been made on the germination of seeds and the growth of vegetables and animals.

In the organism, radium has a very complete action on account of its affinity for certain tissues.

Numerous clinical observations have convinced the author of the beneficial influence of radio-active therapy on ovarian insufficiency. Association of oopherectomy is recommended. This double treatment is particularly indicated in ovarian insufficiency of puberty. The nervous symptoms and menstrual pains are favorably influenced.

HENRY BAYON, M.D.

The X-ray Treatment of Uterine Hemorrhage and Uterine Fibroids L J Carter Canadian Med Assn Jour, November, 1931, XXV, 582-584

This paper is the tenth in the series of papers being contributed by members of the Canadian Radiological Society in the educational campaign. It is being conducted for the purpose of familiarizing the general profession with the accomplishments of physio-therapeutic methods in diagnosis and treatment.

In this article the hope is expressed that through the publication of this and other articles in the

Canadian Medical Association Journal, every family physician in Canada may become familiarized with the benefits which the radiotherapist can confer by X-ray treatment of aggravated and persistent hemorrhage of the menopause. One hundred consecutive cases of uterine hemorrhage and uterine fibroid were reported before the Radiological Society of North America as having received X-ray treatment. All were cured, with the exception of three which proved to be malignant, while in these three the X-ray treatment was a good preliminary measure to the subsequent use of radium and surgery. Similar uniformly good results are reported by all X-ray workers who have published their results.

Emphasis is laid on the fact that the treatment should be carried out only by a radiotherapist who is devoting all of his time to radiology. "For the physician who is only occasionally operating an X-ray machine to attempt the X-ray treatment of uterine hemorrhage is hazardous in the extreme. Over-dosage will precipitate a type of menopause that will be extremely stormy both for the patient and the family physician, while under-dosage will probably only aggravate the hemorrhagic condition." The referring physician should, however, be in a position to give the patient some information concerning the amount of time required to complete the treatment. This would usually consist of three series of treatments one month apart, each series occupying from three to six days, according to the condition of the patient and the particular type of treatment employed. Further, the referring physician should warn the patient that there may be an exacerbation of the hemorrhage following the first series of treatments. Failure to give this warning may make subsequent explanations difficult.

The writer regards as contra-indications to the X-ray treatment of uterine hemorrhage the following: Excessive size of a fibroid tumor, subserous pedunculated fibroid, a large incarcerated fibroid giving rise to urgent pressure symptoms, a submucous fibroid that bleeds subsequent to a course of treatments. Malignancy is a contra-indication for the use of the X-ray alone, to the exclusion of radium and surgery. Pelvic inflammatory conditions are not contra-indications but rather the reverse, providing a pus tube or some other pus pocket is not present, requiring evacuation by surgical methods. The striking results secured in the X-ray treatment of boils and carbuncles find an analogy in the magic disappearance of pelvic inflammations after a course of X-ray therapy.

The X-ray treatment of uterine hemorrhage in women during the child-bearing period should generally be avoided. There is experimental evidence which indicates that the germ cell may be so modified by irradiation as to establish hereditary abnormalities, not in the immediate offspring but in descendants one or more generations removed.

The *modus operandi* of the X-ray in the arrest-

ing of uterine hemorrhage and the reduction of uterine fibroids is generally regarded as being a combination of a number of actions

Radiation is essentially a destructive process, involving the disappearance of the immature rapidly growing fibroid cell and its replacement by fibrous tissue. There is also an endarteritis which shuts off the blood supply of the growing tumor or bleeding uterus, also a direct action on the ovary. The Graafian follicle is either destroyed or undergoes cystic degeneration. The corpus lutea and the internal secretion of the ovary are depressed but not destroyed when the proper dosage is administered. The artificial menopause induced by X-ray does not differ in kind or severity of symptoms from the normal climacteric.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

A Case of Aneurysma Dissecans of the Thoracic Aorta Robert Kienböck and Konrad Weiss Fortschr a d Geb d Röntgenstr, August, 1931, XLIV, 211-214

Retrospectively, an intrathoracic lesion, originally merely reported as an aortic aneurysm with some unusual features, was assumed to be an aneurysma dissecans. It is believed that this diagnosis may occasionally be made *in vivo* in the presence of a dense shadow (nucleus) within a relatively transparent and unusually formed aneurysmatic picture.

HANS A JARRE, M D

New Facts Concerning the Question of Orthocardiography J I Arcoussky Vestnic Rentgenologii i Radiologii, 1931, IX, Nos 2 and 3, p 133

The author presents a full discussion of orthocardiography of the heart and aorta. He considers orthocardiography to be a very valuable roentgenologic method of investigation, but as it is now practised, the method is not adapted to clinical study. His modifications make the method of greater usefulness in clinical medicine. Upon the basis of his investigations and measurements of the heart, he succeeded orthodiagnostically in proving that the volume of the heart increases at the moment of inspiration.

SAMUEL BROWN, M D

Persistence of the Right-sided Aortic Arch, Demonstrated Radiologically Klaus Mardersteig Fortschr a d Geb d Röntgenstr, August, 1931, XLIV, 163-169

This is a case report. By careful roentgenologic examination suspected specific aortitis could be

ruled out. A persistent right-sided aortic arch was found associated with a congenital ventricular septal deficiency. The esophagus and trachea were considerably displaced by a persistent left-sided aortic root (knob), resembling an aortic diverticulum.

For literature on this subject see Biedermann *Fortschr auf dem Gebiete der Röntgenstrahlen*, 1931, XLIII, 168

HANS A JARRE, M D

HERNIA

Retroperitoneal Parajejunal Hernias or Hernias of Treitz and of Waldeyer Georges Brohée Arch d mal de l'app digestif, July, 1931, XXI, 794-812

The depressions described by Treitz and Waldeyer are parajejunal on the right and left sides, not para-duodenal. They are three in number right, left superior and inferior. The various theories of development are described and found to be insufficient.

Rarely retroperitoneal hernias may develop at these points. About 175 have been reported, about 30 of which were on the right side. Four clinical types are recognized: the insidious, the type due to diarrhea, to constipation, and the acute or subacute occlusive type. Vague digestive disturbances, resisting all medication, mesogastric pain radiating to the left, tumefaction to the left of the vertebral column in the umbilical region are all strong presumptive signs. The radiologic findings are not fixed. The diagnosis is seldom made pre-operatively and the prognosis is that of all abdominal hernias.

Treatment depends on circumstances in the occlusive or strangulated type, if the strangulated area does not preserve its vitality, debridement is recommended, in other types, a reduction of the hernia followed by an obliteration of the orifice, directly or indirectly, is the treatment of choice.

B J DE LAUREAL, M D

HODGKIN'S DISEASE (DIAGNOSIS)

Roentgenologic Study of Intrathoracic Lymphoblastoma. B R. Kirklin and Hans W Hefke. Am Jour Roentgenol and Rad Ther, November, 1931, XXVI, 681-690

The authors studied and analyzed the intrathoracic roentgenologic findings in sixty-seven cases of lymphoblastomas, these being sub-classified by clinical and microscopic findings as Hodgkin's disease (forty cases), lymphosarcoma (seventeen cases), and leukemia (ten cases). X-ray changes in the chest were

seen oftener (50 per cent) in cases of Hodgkin's disease than in cases of lymphosarcoma or leukemia (20 per cent)

The proven cases of Hodgkin's disease were divided into two groups, the larger group comprising 62 per cent of the cases showing mediastinal and hilar node changes only, the smaller group of 30 per cent showing involvement of the pulmonary tissue, either infiltrative or metastatic, with or without node involvement. The most commonly seen changes in the cases of Hodgkin's disease consisted of multiple well-defined discrete rounded or oval shadows in one or both hilar regions, with a more or less lobulated superior mediastinal shadow. The cases with lung involvement showed a much more variable picture, some resembling the patches of bronchopneumonia, one resembling extensive bronchiectases, and several simulating primary or metastatic pulmonary neoplasm.

The seventeen cases of lymphosarcomas all showed either mediastinal or hilar node involvement, or both. The majority of the cases showed bilateral, lobulated mediastinal widening. Four of the seventeen cases revealed pulmonary involvement also. The appearances of the ten cases of leukemia showing intrathoracic involvement were not appreciably different from the cases of lymphosarcoma. Four cases of leukemia showed pulmonary as well as node involvement.

The authors conclude that there is no absolutely characteristic difference in the roentgenologic appearance of these closely allied malignant lymphomas. Differentiation from aneurysm, benign tumors, substernal goiter, carcinomatous and sarcomatous metastases, primary carcinoma of the lung or bronchus, pulmonary tuberculosis, Pott's abscess, marked dilatation of the esophagus, and mediastinitis must be made.

J. E. HABBE, M.D.

THE KIDNEY

Pyelographic Evidence of Horseshoe Kidney. Report of a Case in a Girl Thirteen Years of Age. Samuel J. Sinkoe. Am. Jour. Surg., January, 1932, XV, 51-55

A correct pre-operative diagnosis of horseshoe kidney is not a simple matter, and it is only on the operating table or in the autopsy room that we are able to confirm our diagnosis. There are, however, certain clinical facts in addition to our pyelographic findings which may justify one in arriving at a tentative diagnosis, and should any surgical emergency arise in a patient suspected of having this congenital anomaly, the surgeon should be on guard and proper measures should be carried out accordingly. The

anomalous rotation of the renal pelvis, the unusual location of the calyces, the finding of the renal shadow lying close to the vertebral column, the abnormal insertion and shortening of the ureter, the visibility of the presence of an isthmus, all point to a definite renal abnormality, and that abnormality suggests a horseshoe kidney. Clinically, the presence of Rovsing's sign may be of great value. One must also remember that horseshoe kidney is more liable to infection than a normal kidney, and may be subject to various diseases, such as stone, tuberculosis, pyonephrosis, etc. One must, therefore, be on guard for suggestive symptoms and treat the condition accordingly.

In conclusion, the author emphasizes the fact that in congenital anomaly of the kidney, especially of the horseshoe variety, stasis and infection are usually present and proper therapy depends upon carrying out ureteral dilatation and pelvic lavage in order to alleviate the patient's symptoms.

The writer has included a brief review of the literature on this subject, together with detailed accounts of a case reported by D. N. Eisendrath and one of his own. Interesting pyelo-ureterograms accompany the article.

The importance of a thorough urologic investigation of individuals with a persistent pyuria is emphasized.

DAVIS H. PARDOLL, M.D.

Nephroptosis Its Diagnosis and Treatment. Jay J. Crane. Calif. and West. Med., September, 1931, XXXV, 201-204

The author discusses surgical fixation of the kidney as practised before the modern methods of diagnosis were used, noting particularly that many times there was failure to relieve the symptoms. To-day he does not advise anchoring every floating kidney, and, therefore, limits himself in this line to those kidneys in which urinary stasis is found, with the aid of the cystoscope and X-ray.

Under the heading of symptoms he notes that he has come to rely on the X-ray findings for the position, rather than on palpation of the kidney. He divides the kidney mobility into three degrees, namely First degree, when the pelvis rests opposite the third lumbar vertebra, second degree, when the pelvis rests opposite the fourth lumbar vertebra, and third degree, when the pelvis rests opposite the fifth lumbar vertebra.

Diagnosis is made by the subjective symptoms and the findings, sometimes by palpation, plus the objective evidence of pathology as demonstrated with the X-ray and cystoscope and the reproduction of the pain by injection of pyelographic fluid. The surgical treatment is also discussed.

FRANCIS B. SHELTON, M.D.

Solitary Cyst of the Kidney Report of Two Cases Joseph A Lazarus Urol and Cutan Rev, November, 1931, XXXV, 698-703

In the seventeenth century, Fabry, of Hilden, a famous German surgeon, and the noted English internist, Thomas Willis, made some interesting observations on renal cysts. The first precise remarks concerning cystic renal disease are to be found in Rayer's treatise on disease of the kidneys, published in 1837. In 1867, Laveran, in his monograph, distinguished between solitary renal cysts and polycystic disease of the kidneys.

A solitary cyst of the kidney is a typically benign cyst, usually of considerable size, and situated, as a rule, in one pole of the kidney. It may be designated as "serous" if its contents are clear and watery, or "hemorrhagic" if they are bloody. The serous cyst, which is the more commonly observed, is lined with an epithelial layer of flat or low cuboid cells. As a rule, there is no communication between the cyst and the kidney pelvis. Numerous theories regarding the pathogenesis of solitary cysts have been offered, but the preponderance of evidence thus far adduced seems to favor the theory that solitary renal cysts are congenital and bear a close relationship to polycystic renal degeneration. There is, likewise, a great variance of opinion regarding the site of origin of such cysts.

This condition gives rise to no pathognomonic symptoms. The cyst is accidentally discovered at autopsy, or during an exploratory operation in some cases. Pain of a dull and dragging character is present in many cases. Pressure upon neighboring organs may give rise to symptoms in those organs. Hematuria has been reported in only two cases.

The author believes that a tentative diagnosis can be made by a careful reading of the plain roentgenogram. In this condition the X-ray will reveal a globular enlargement of one of the renal poles of lighter density than the remainder of the renal shadow, or a notching of the convex border of the kidney at its point of attachment to the cyst. A distinct line of demarcation between the cyst and the kidney may be seen in some cases. In cysts of the lower pole a medial deviation of the opaque ureteral catheter may also occur. According to Braasch, pyelography shows a shortening of adjacent calices, a flattening of the portion of the pelvis in contact with the cyst, and a change in the axis of the kidney, due to the weight of the cyst. While, as a rule, the pyelographic findings in solitary cyst are distinct from those of tumor of the kidney, in certain cases the differential diagnosis of the two conditions is impossible. Palpation usually reveals an enlarged renal mass.

The treatment of solitary cysts of the kidney is surgical. In cases with good functioning renal parenchyma, the cyst is completely removed with the

entire lining. Following extirpation of the cyst the kidney should be suspended. In those cases in which the cyst is in intimate contact with the renal pedicle, nephrectomy must be done.

The author reports two cases illustrating the points mentioned by him to be observed in diagnosis and treatment. The first case was that of a woman, 63 years of age, who presented a solitary serous cyst, involving the lower pole of the right kidney. The pre-operative diagnosis was made from the plain roentgenogram, and nephrectomy was performed. The second case was that of a woman, 53 years of age, with involvement of the lower pole of the left kidney. A tentative pre-operative diagnosis of solitary cyst was made from the plain roentgenogram. Owing to the finding of blood in the specimen obtained from that kidney, tumor could not be ruled out prior to operation. Partial nephrectomy was performed in this case.

J N ANÉ, MD

LIGHT THERAPY

On the Photochemical Decomposition of Hemoglobin and the Relations of the Reaction to Chlorophyl G Kögel Strahlentherapie, Oct 3, 1931, XLII, 379-383

On the Acceleration of the Reduction of Methylene Blue by Proteins under the Influence of Light. G Kögel Strahlentherapie, Oct 3, 1931, XLII, 384, 385

In the first article the author relates his experience with the effects of light on chlorophyl solutions under the influence of sensitizing substances. Hemoglobin and its derivatives were also studied. It appeared that the sulphydryl group was most effective in the splitting up of hemoglobin.

In the second paper the effect of several amino acids on the reduction of methylene blue were investigated. Leucine, alanine, and glycocoll seem to be most active.

ERNST A POHLE, MD, Ph.D

The X-ray as a Complement to Actinotherapy Sir Howard Humphris Canadian Med Assn Jour, September, 1931, XXV, 311-314

As radiography should not be considered an entity in diagnosis but kept in correlation with other methods of diagnosis, there seems to be reasonable grounds for assuming that the X-ray can be used as a valuable adjunct to the rays of the spectrum not far removed from it. Especially is this true of ac-

tinotherapy, since the space between X-rays and ultra-violet has been bridged spectroscopically by Millikan and Holweck.

As instances of diseases in which the X-rays and actinotherapy may supplement the action, the one of the other, the author quotes from the work of Bayliss and Sampson. The former states "The effect of the X-rays on cells is similar to that of ultra-violet light. Their lethal effect, however, continues for a long period." Sampson says "In lupus vulgaris, often after the first few actinic-ray treatments, a dermatitis dose of X-rays is of the greatest utility." Again in psoriasis some of the more recent areas cleared up promptly under actinotherapy, but some of the older and more indurated regions were intractable until the ionizing X-ray dose was given.

Even as they may be used together clinically, X-rays sometimes, not indiscriminately however, may be given when there is dermatitis from ultra-violet radiation. When the ultra-violet radiation is given to increase skin tolerance the reaction should be allowed to die down before administering the X-rays. In lupus vulgaris, in cases in which it is desirable to produce extreme dermatitis, the best results are obtained by superimposing the X-rays upon the ultra-violet dermatitis.

In considering team work between X-ray and ultra-violet radiation, let us recall the way in which the former produces its therapeutic effects.

1 The endothelial lining of the blood vessels becomes edematous, this edema eventually occluding the artery and cutting off the nutrition of the growth, and resulting, if the treatment is pushed to that extent, in an obliterating endarteritis in the capillaries.

2 X-rays appear to have special action on new cells and on elementary embryonic tissue. Here the nucleus becomes cloudy, the nuclear membrane disappears, and then is carried away by the process of phagocytosis, and replaced by connective tissue in those cases in which the treatment is prolonged.

These and other changes that are brought about greatly depend upon the blood condition of the patient. We have seen that ultra-violet rays are actually absorbed by the capillaries, and cause chemical changes in the composition of the blood. This consideration may explain the mechanism by which are brought about the good effects of the combined use of the two measures.

The problem of the successful use of the combined measures of X-ray and actinotherapy involves, *inter alia*, two main questions. These are the measure of the sensitivity of the pigmented skin to the X-rays, and the possibility that such simultaneous and combined application may be productive of cumulative effect. Researches show that the pigmented skin is not abnormally sensitive to such treatment. Should, however, the skin be exposed to the ultra-violet rays of the quartz lamp, the result is somewhat different. If the ultra-violet rays are found

to produce a violent reaction, the effect of the X-rays would be to increase it. Such treatment should, therefore, be reserved for those cases in which previous light treatment has brought about a certain degree of tolerance of the tissues. So far as cumulative action is concerned there is no evidence of any harmful effect from the combination of treatments.

In considering the therapeutic effect of these two agents, it is interesting to contrast their several actions on the skin. Either will produce a dermatitis, but the X-ray one takes weeks, months, or even years to develop, while that from ultra-violet occurs in a few hours. X-ray dermatitis causes baldness, while the ultra-violet stimulates the growth of hair. Atrophic changes may develop from X-ray dermatitis, while the ultra-violet causes little more than desquamation. The irritability of a given area is increased following an X-ray dermatitis, while it is decreased following an ultra-violet dermatitis.

The conjoined employment of X-ray and actinotherapy followed the observation that X-ray dermatitis, if not too severe, yielded readily to the application of the ultra-violet. If, however, cicatrical tissues have formed, these must be softened up by X-ray treatment before the ultra-violet will be effective.

In conclusion, the author regards as definitely proven the facts that X-ray and ultra-violet are mutually complementary methods of treatment. Each has added to the field of usefulness of the other, when used to supplement it, under carefully selected conditions. Up to the present, research has not gone far enough to make it possible to postulate any exact technic for the combined use of the two measures.

L J CARTER, M.D.

THE LIVER

Flat Film of the Liver Arthur Wolf Röntgen-praxis, Aug 15, 1931, III, 732-739

A flat film of the liver, if technically good, gives a considerable amount of information. One is usually able to show the lateral and the lower edge of the liver up to the gall-bladder region. Changes in the shape and size of the liver can usually be demonstrated. In one case, a carcinomatous nodule could be seen on the lateral edge of the liver.

H W HEFKE, M.D.

New Methods of Radiologic Visualization of the Liver and Spleen Carlos B Udaondo, Eduardo Lanari, Pedro A Maissa, and Juan C Galan

Prensa Med Argentina, July 10, 1931, XVIII, 161-166

The authors present five cases of visualization and follow the method introduced by Radt. They use Tordiol and Heyden 1,073 A., giving from 10 to 20 c.c. intravenously daily until a total of from 40 to 80 c.c. have been given. Their results were very good, and they conclude that the method of Radt is a great step in the diagnosis of diseases of the liver. Only one case showed intolerance of the substance as indicated by slight rise in temperature, dizziness, and headaches.

N G GONZALEZ, M D

MASTOID

Radiographic Evidence of Mastoid Pathology
Richard A Rendich Med Times and Long Island
Med Jour, September, 1931, LIX, 319, 320

The roentgenogram serves as an anatomic as well as a pathologic study of the mastoid. It furnishes information concerning the type and size of the mastoid, its development, size and extension of cells, thickness of the cell walls and mastoid cortex, and the position and course of the lateral sinus and emissary vein. Pathologically, the decrease of aeration indicates the amount of serum, purulent material, or granulation tissue in these cells, structural changes in the septa being shown by changes in density. An abscess of the mastoid is recognized by absence of cell septa in a more or less irregular spherical area of varying size, delimited by a zone of slightly increased density. Sclerotic mastoid is readily distinguished by absence of cells and a dense eburnated triangular area marked posteriorly by the lateral sinus groove. An acute exacerbation of an otitis media will give no X-ray evidence in a mastoid of this sort. The radiograph must show the entire mastoid in the finest detail. It is then a distinct aid in deciding on surgical procedures.

W W WATKINS, M D

MEDICAL PRACTICE

A Radiologist's Duty to His Specialty Charles M Richards Calif and West Med, June, 1931, XXXIV, 395, 396

The author criticizes the profession for using the lay laboratory and for oftentimes accepting diagnosis from these laymen. At the same time he condemns the radiologist for not being a true consultant, stating that he has oftentimes not seen the patient or demanded the history or clinical findings to

assist him in making his diagnosis, and that he has not stressed the point that the work of the radiologist is after the films are made.

The fact that the practice of radiology is in every sense the practice of medicine should be impressed on our medical confreres, by the conduct of our work both at the hospital and in private practice. In connection with the report of the death of a member of our specialty, the author notes there was used the following significant statement "He was a physician, practising radiology."

FRANCIS B SHELDON, M D

The Training in Radiology for the Dermatologist
A Stühmer Strahlentherapie, Oct 24, 1931, XLII,
599-604

The author, who holds the chair of Dermatology at the University of Munster, outlines in this article his opinion concerning the training of specialists in radiology as the dermatologist sees it. In view of our interest in all matters of training regarding our chosen field of endeavor, his conclusions will be related here.

The creation of chairs for general and clinical roentgenology to be occupied by a physician must be demanded. A radiation institute for teaching and research purposes is essential. In such an institute the students should be taught roentgen physics, radiobiology, general clinical roentgenology, as well as biology of light and light therapy. Special courses should be given for clinical assistants in order that their knowledge of roentgenology may be widened. More attention should also be paid to roentgenology in the clinical teaching. It should also become obligatory for the student to pass an examination in radiology.

He says "The training of physicians using roentgen rays for the treatment of skin diseases should be supervised by the dermatologist." A specialist in radiology should, therefore, not include among his activities the treatment of skin diseases, since that presupposes a complete training in dermatology. If radiation institutes desire to treat skin diseases, such a procedure is acceptable, from the standpoint of the dermatologist, only if he is in complete charge of the case and of the treatment.

ERNST A POHLE, M D, Ph D

PHYSIOTHERAPY

Hyperpyrexia, a New Field for Physical Therapeutics Clarence A Neymann Brit Jour Phys Med, October, 1931, VI, 141-144

The author discusses the production of fever with high frequency currents and describes the technic

used in application when the body temperature is to be raised to about 104° Fahrenheit. He states that it usually requires from one and one-half to two hours before 104.5° is reached, but it is very easy to maintain this temperature for periods of from five to eight hours, providing the patient is adequately insulated. A temperature recording device is also described.

The results in the treatment of eighty-five cases of general paresis at the Cook County Psychopathic Hospital, the Elgin State Hospital, and in private practice are enumerated.

In this series, "41 per cent of these patients showed an absolute clinical remission, and returned to their former occupations, 19 per cent made a partial recovery and were able for the most part to adjust themselves outside an institution, and 40 per cent remained unimproved. These results are the more noteworthy since only 34 patients (about 40 per cent) had what we now consider adequate treatment, i.e., at least 100 hours of fever above 103.5° Fahrenheit. Some have received as many as 50 treatments, with over 200 hours of fever above 103.5°."

The results in tertiary endarteritic syphilis of the brain, Parkinsonian syndromes, and arteriosclerotic conditions do not appear to yield as good results.

The author also states that, "Three years have elapsed since the first cases were discharged from custodial institutions. Thus far not a single case has been recommitted. There seems no mental deterioration in any of the discharged cases of this series, whom we have been able to re-examine from time to time."

WILLIS S PECK, MD

RADIATION

Radiation Therapy of Carcinoma of the Fundus
Iwan v Büben Strahlentherapie, Nov 14, 1931,
XLII, 769-774

During the period from 1919 to 1929, the author observed 101 cases of carcinoma of the fundus. Thirty-eight of these had never had any pregnancy, two were virgins, 14 had one child each, and 49 had had several pregnancies. Forty-five were irradiated and 56 operated on. Histologically there were 86 patients with adenocarcinoma 13 with carcinoma solidum, and two with carcinosarcoma. Twenty-eight of the cases operated on could be observed over five years, 12 of these were cured (42.9 per cent). Radium and roentgen rays were used in combination. From 50 to 75 mg in a silver brass screen, equivalent to 10 mm Pt were inserted in rubber tubes intra-uterine to give a dose of from 2,400 to 3,600 mg-hrs in the uterus and from 2,000 to 2,400 mg-hrs in the vaginal wall. Three series of roentgen treatments were given,

using from 2 to 6 fields each time, the dose per area being 470 r (measured in air) produced at 183 K.V., 5 ma, 0.5 mm Zn + 0.5 mm Al at 30 cm. F.S.D. Examinations of the patients took place first every six weeks, then every three months. Twenty-six patients could be observed for five years, nine remained well less than one year, five remained well for one year, seven for two years, one for three years, one for five years, one for six years, one for seven years, and one for eight years. Four women are considered cured, corresponding to 15.3 per cent.

The author states that the question of radiation therapy of carcinoma of the fundus cannot be considered as a solved problem. However, he feels that the results are so encouraging that further efforts should be made to improve what has been accomplished so far by irradiation.

ERNST A POHLE, MD, PhD

Radium Irradiation with and without Filter
George Schaprirger Strahlentherapie, Oct. 3, 1931,
XLII, 386-393

The author analyzes the most common types of radium applicators and their effect on tissue. Expressing the amount of radiant energy emitted as alpha-, beta-, and gamma-rays in calories per hour, he comes to the conclusion that it does not suffice to indicate dosage in milligram-hours. It is necessary to specify the percentage of alpha-, beta-, and gamma-rays affecting the irradiated tissue. He gives some examples illustrating his method.

ERNST A POHLE, MD, PhD

Chronic Myelogenous Leukemia Value of Irradiation and Its Effect on the Duration of Life. William J Hoffman and Lloyd F Craver Jour Am Med Assn, Sept. 19, 1931, XCVII, 836-840

Since the disease is comparatively rare, its gradual development makes it difficult to determine the exact time of onset.

The average duration of life after the onset of the disease was 3.36 years, and varied from more than sixteen years to as little as six months. Eighty-two cases of myelogenous leukemia are analyzed and compared with a series of 130 cases reported by Minot, Buckman, and Isaacs. The decade of greatest incidence is that between thirty-four and forty-five years. The incidence of the disease increases from infancy to thirty years of age and from that time onward remains practically constant. The youngest patient in their series was fourteen and the oldest sixty-six years. The disease is rare below twenty-five years. In their series 68 per cent were males and 32 per cent were females. Splenomegaly was present in seventy-seven of the eighty-

two patients at the time of diagnosis, indicating that the disease is rarely recognized before this enlargement has developed

Comparison with Minot's group of non-irradiated patients showed that irradiation actually adds little to the duration of life in this disease. Irradiation early in the course of the disease had no effect on the duration of life. Repeated cycles of irradiation produce remarkable improvement in the condition of patients. The effect, while temporary, lasts from a few months to a year, repetition of the treatment being necessary. The average duration of efficient life after the diagnosis of the disease was 30 per cent greater in their irradiated patients than in Minot's non-irradiated patients. The radiation treatment causes an average increase of about ten months in the duration of efficient life—a period of usefulness that the patient otherwise could not hope to enjoy.

C G SUTHERLAND, M B (Tor.)

Roentgen Therapy of Carcinoma of the Penis
Juraj Körbler Strahlentherapie, 1931, XLII, 780-783

The author describes two cases of carcinoma of the penis treated by roentgen rays with the following technic: 15 H filtered through 0.5 Cu + 10 Al given over two areas in two sittings three weeks apart. The inguinal lymph nodes were involved in the first case and were removed by operation. Although the primary tumor responded well to roentgen rays, a recurrence developed in the preputium, and the biopsy showed carcinoma. Amputation was carried out, therefore.

The second case was a student, 23 years old, who had a tumor along the entire circumference at the insertion of the preputium. The inguinal lymph nodes were removed but did not show any involvement. X-ray therapy was started in August, 1927. The tumor responded well, and eight months after the treatment no traces of it could be found. However, the patient developed phimosis and was operated on. Histologic examination of removed tissue did not show any carcinoma. Re-examination was done four years afterwards, and the patient is still well. The author believes that it is worth while to give roentgen therapy a trial in carcinoma of the penis in order to avoid amputation, if possible.

ERNST A POHLE, M D, Ph D

Roentgenotherapy of Hay Fever F E Haag and H Schreus Strahlentherapie, Oct 24, 1931, XLII, 485-491

Roentgenotherapy in cases of hay fever is given over the entire nose, using a 0.5 mm. Cu filter, 6 X 8 cm field, 120 r up to three times every two or three days. No other therapy was applied, in order to

obtain correct statistics. Of sixteen cases, six had good results, one temporary improvement, eight did not respond, and one could not be traced. Studies of the skin reactions following a pollen vaccination showed that they run parallel to the clinical symptoms. The reactions during the period of roentgenotherapy were also observed. In some cases the reactions did not appear at all and in others the number and intensity were decreased, while in some there was an increased response.

ERNST A POHLE, M D, Ph D

Studies on the Effect of the Time Factor in Roentgen Irradiation R. Glocker, H Langendorff, and A Reuss Strahlentherapie, Sept. 12, 1931, XLII, 148-156

In this study of the influence of the time factor in irradiation the authors differentiate two stages. First, exposures of such a duration that the velocity of growth of the cell during irradiation can be neglected. It can be expected in such a case that photochemical laws govern the effect of the time factor. Second, exposures which extend over such time intervals that the status of the cell undergoes definite changes. In that case there occur biologic processes which must vary in different objects and cannot be expressed by a general law. Bean seeds and eggs of axolotl were used. It was found that for exposures of short duration (up to one hour for beans, up to one-half hour for eggs of axolotl) the effect of the time factor for intensity changes 1/200 followed Schwartzschild's law. The exponent in this law is 0.96 for beans and 0.95 for eggs of axolotl. A graph is appended which permits the determination of the necessary corrections for the exposure time. If the interval between two fractional doses is varied, then the percentage of injury changes according to the length of the interval. The effect is directly related to the number of mitotic cells present at the time of the second exposure.

ERNST A POHLE, M D, Ph D

Roentgenotherapy in Non-malignant Disease of the Central Nervous System Gerd Kohlmann Strahlentherapie, Oct 24, 1931, XLII, 453-465

The author outlines, briefly, the indications and method of treatment in non-malignant diseases of the central nervous system. He begins with inflammatory processes as, for instance, tabes. Twenty-three cases with crisis were treated, fifteen responded well, six moderately well, and two did not respond at all. The technic was as follows: 3 or 4 fields 10 X 15 sq cm, 30 cm FSD, 180 K.V., 0.5 Cu + 1 mm Al, from 40 to 50 per cent H.E.D. per field. The entire spinal cord is irradiated, one field every second day. A second series may be

used in application when the body temperature is to be raised to about 104° Fahrenheit. He states that it usually requires from one and one-half to two hours before 104° is reached, but it is very easy to maintain this temperature for periods of from five to eight hours, providing the patient is adequately insulated. A temperature recording device is also described.

The results in the treatment of eighty-five cases of general paresis at the Cook County Psychopathic Hospital, the Elgin State Hospital, and in private practice are enumerated.

In this series, "41 per cent of these patients showed in absolute clinical remission, and returned to their former occupations, 19 per cent made a partial recovery and were able for the most part to adjust themselves outside in institution, and 40 per cent remained unimproved. These results are the more noteworthy since only 34 patients (about 40 per cent) had what we now consider adequate treatment, i.e., at least 100 hours of fever above 103.5° Fahrenheit. Some have received as many as 50 treatments, with over 200 hours of fever above 103.5°."

The results in tertiary endarteritic syphilis of the brain, Parkinsonian syndromes, and arteriosclerotic conditions do not appear to yield as good results.

The author also states that, "Three years have elapsed since the first cases were discharged from custodial institutions. Thus far not a single case has been recommitted. There seems no mental deterioration in any of the discharged cases of this series, whom we have been able to re-examine from time to time."

WILLIS S. PECK, M.D.

RADIATION

Radiation Therapy of Carcinoma of the Fundus
Iwan I. Büben Strahlentherapie, Nov. 14, 1931,
XLII, 769-774

During the period from 1919 to 1929, the author observed 101 cases of carcinoma of the fundus. Thirty-eight of these had never had any pregnancy, two were virgins, 14 had one child each, and 49 had had several pregnancies. Forty-five were irradiated and 56 operated on. Histologically, there were 86 patients with adenocarcinoma, 13 with carcinoma solidum, and two with carcinosarcoma. Twenty-eight of the cases operated on could be observed over five years, 12 of these were cured (42.9 per cent). Radium and roentgen rays were used in combination. From 50 to 75 mg in a silver brass screen, equivalent to 10 mm Pt were inserted in rubber tubes intra-uterine to give a dose of from 2,400 to 3,600 mg-hrs in the uterus and from 2,000 to 2,400 mg-hrs in the vaginal wall. Three series of roentgen treatments were given,

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appeared on the amputation scar of the right index finger, with enlarged right supraclavicular nodes and also a tumor in the right breast

In April, the patient died, after having severe pain in the abdomen and right hip followed by paralysis of the right leg. At necropsy, metastases were found in the lymph nodes of the hilum of the right lung, heart, liver, pancreas, stomach, spleen, kidneys, left suprarenal, and appendix. The authors state that this is the first case of occupational X-ray cancer on record in Japan

F CAVERS, D Sc.

The Danger of Roentgen Carcinoma Developing after Roentgenotherapy H Holthusen and K Engmann Strahlentherapie, Oct 24, 1931, XLII, 514-531

Carcinoma developing in irradiated areas has been reported, however, the percentage of incidence is very small. It seems that professional workers are much more in danger in that respect than a patient treated by irradiation. The authors relate the history of a man who, at the age of 26 years, received superficial roentgenotherapy because of syrosis barbae. Immediately after the treatment he developed an acute reaction in the face, the neck, and upper chest. The epidermis underwent necrosis, and only eight months after the treatment complete epithelialization had occurred. One year after the exposure he was treated because of skin necrosis in several areas in the neck. These healed, however, under radiation therapy (the type of radiation is not stated). Atrophy of the skin developed in the following years, which interfered greatly with the motion of the head, particularly with the function of the mandible during eating and talking. In 1924, a large ulcer appeared in the left cheek, which healed after from six to seven weeks. In 1929, a small growth developed on the right cheek. Though this growth dropped off, it recurred repeatedly. He returned for examination in June, 1929, and a diagnosis of roentgen carcinoma was made. Biopsy showed a typical squamous cell cancer. There was also a small gland in the right submandibular region. Radium therapy could not halt the process, but the growth increased in size, and broke through into the mouth until a hemorrhage from the temporal artery and subsequent pneumonia ended the patient's sufferings.

Thirty-nine cases collected from the literature are briefly quoted. An analysis of these shows that carcinoma develops most frequently in patients who have received several series of exposures. Head, vulva, and anus are more frequently involved. In conclusion, it is stated that the occurrence of a roentgen carcinoma following irradiation for therapeutic purposes is extremely rare. Since 1910, only three cases have been observed.

ERNST A. POHLE, M D, Ph D

The Treatment of X-ray Burns with Rays of Long Wave Length W Bröcker Strahlentherapie, Oct. 24, 1931, XLII, 551-570

Experiments showed that exposure to infra-red light applied before or after roentgen exposure does not influence the roentgen reaction of the human skin. In the animal experiment a prophylactic effect of infra-red rays toward roentgen injuries could not be proved. A roentgen ulcer appeared, regardless of infra-red exposure being applied before or after roentgen irradiation. Clinical experience has shown, however, that infra-red light is of value in treating already existing roentgen burns. Two cases are reported, the X-ray injuries of which healed following exposure to infra-red light, although all other therapeutic measures had failed to bring relief.

ERNST A. POHLE, M D, Ph D

RADIUM

Radium and Microglia Desiderio Perotti Riv di radiol e fisica med, December, 1931, IV, 175-178

The author inserted under the skull of rabbits a tube of 10 mg radium element filtered with 1 mm platinum and left it in place in one animal for 48 hours, in another for 108 hours. He found the changes produced by this method of irradiation were quite similar to those produced by the X-ray. There was a heaping up of microglia cells in the white submeningeal layer of the cortex. This, the author thinks, is due to the larger dose of radiation received by the submeningeal layer in comparison to that received by the deeper layers distant from the radium-bearing tube.

This accumulation of microglia cells, whose phagocytic power is evident where the radiation is most intense, seems to be of much importance in the regression and cure of cerebral tumors treated by radiotherapy.

E T LEDDY, M D

Plastic Apparatus Made from Reinforced Paraffin-wax ("Gammoplast") for Use in Superficial Radium Therapy Gian Giuseppe Palmieri and Giovanni Paltrinieri Riv di radiol e fisica med, December, 1931, IV, 150-174

The authors discuss the use of "gammoplast," first described by them in 1929, as used in moulded applicators in the Radium Institute of Bologna. This technic avoids the main drawbacks found in the usual plastics, such as brittleness, great weight, difficulty of moulding to exactly fit the lesion, and expense of preparation of the "moulage." Numerous photographs illustrate the preparation and clinical applications of the authors' devices.

E. T. LEDDY, M D

given after from six to seven weeks and a third series after three months. In gastric crisis one can also apply from 20 to 25 per cent H.E.D. to the plexus solaris.

Poliomyelitis can be treated also, particularly in combination with diathermy. The entire spinal cord is treated through 4 fields of entry, acute cases receive from 25 to 30 per cent H.E.D. and in chronic cases 50 per cent of the H.E.D. is given. If only the lower extremities are affected, it suffices to apply 2 fields to the lower part of the spine. Not so favorable are the results in roentgenotherapy of encephalitis. In acute meningitis other methods are much more important. Roentgenotherapy may be given a trial in cases of solitary tuberculosis, particularly if it has been localized by operation. In multiple sclerosis, from 20 to 25 per cent H.E.D. can be given per field. Twelve out of seventeen cases were considerably improved. In cases of chronic headache, relief has also been obtained following the application of from 30 to 35 per cent H.E.D. in two or three series at from six- to eight-week intervals. Cases with traumatic compression and those of meningitis serosa do sometimes respond well to roentgenotherapy. The same holds true of hypersecretion, as, for instance, in patients with liquor fistula. The author has seen good response in epilepsy, it takes, however, many series of treatments and sometimes as long as two years until a definite improvement can be noticed. The technic consists of 50 per cent H.E.D. through 4 fields of entry (9×12 sq cm). Syringomyelia seems to be very suitable for radiation therapy. The technic of treatment is similar to that in tabes and multiple sclerosis. Raynaud's disease ($\frac{1}{3}$ H.E.D., three series at from four- to eight-day intervals over the cervical and lumbar spine), torticollis (75 per cent H.E.D., distributed over three successive days), neuralgia (60 per cent H.E.D. over both central and peripheral nerves), and paralysis agitans (20 per cent H.E.D. directed to the fourth ventricle, 5 fields, to be repeated once or twice at from four- to six-week intervals) have also been tried in some cases with success. Reference is made to the work of Wieser, who, for the past several years, has irradiated mongoloid children. In conclusion, it is stated that not enough attention is paid to roentgenotherapy in non-malignant diseases of the central nervous system.

ERNST A. POHLE, M.D., Ph.D.

RADIATION INJURIES

Injuries Resulting from the Application of Electro-physical Treatment Methods F. M. Groedel and Heinz Lossen Strahlentherapie, 1931, XLI, 372-394

The entire material collected in four medico-legal cases following the use of the quartz mercury vapor

lamp, the solux lamp, diathermy, and radium is published by the authors and should be looked up in the original by those interested in this subject.

ERNST A. POHLE, M.D., Ph.D.

The Problem of Total Body Exposure to Roentgen Rays F. M. Groedel and Heinz Lossen Strahlentherapie, Oct. 24, 1931, XLII, 532-538.

Total body exposure to roentgen rays has been suggested in the treatment of malignant tumors and was tried out recently in cases of leukemia and generalized skin disease. The danger of too high a total dose, because of the enormous absorption, is strikingly shown in a case seen by the authors. A man, 61 years of age, who had psoriasis involving almost the entire body, received exposures in numerous small areas distributed over a number of sittings. In a first series given in December, 1928, a total of 247 per cent H.E.D. was applied. In February, 1929, he received a total of 290 per cent H.E.D. In March, 1929, he received a total of 1,345 per cent H.E.D. In May, 1929, he received 1,830 per cent H.E.D. applied over thirty-seven areas. This brought the total dose given to the patient to about 38 H.E.D. During the entire time no blood examination had been made. Immediately following the last exposure in extreme anemia was observed and there were 2,350,000 red blood cells, 3,200 white blood cells, and 47 per cent hemoglobin. Under As and liver therapy combined with blood transfusions this typical aplastic anemia healed slowly. The importance of blood examinations during an extensive series of X-ray therapy is emphasized and a warning is issued concerning the dangers of excessive general body exposure.

ERNST A. POHLE, M.D., Ph.D.

Occupational X-ray Carcinoma H. Yamakawa and K. Shimadai Gann, 1931, XXV, 1-4 (Reprinted from "Cancer Review" by permission)

A man, 51 years of age, who had been employed in an X-ray laboratory for seventeen years had, ten years prior to being examined by the authors, noticed on the back of his hands a number of small warts which he treated with ointments. In 1926, a painful ulcer appeared on one of the warts, and as it did not heal, the finger (right index) was amputated. In July, 1929 an ulcer on the right middle finger was treated by amputation of the two terminal phalanges. Microscopic examination showed a deeply infiltrating medullary carcinoma of the anaplastic basal-celled type. Soon after this there appeared enlargement of the lymph nodes of the right elbow and axilla, which were removed in September. Shortly afterwards recurrence of the growth

made. A blood-count and Wassermann reaction should be done and a renal efficiency test carried out. In many cases of carcinoma of the cervix, death is due, not to cachexia, but to complicating uremia. Biopsy is also indicated in all cases. According to the author it is not an operation tending to cause dissemination of the disease.

The following classification is used: (1) The growth is early when it is limited entirely to the cervix, (2) The growth is borderline when, in addition to the cervix, it involves an adjacent vaginal wall or parametrium, but is still freely movable on bimanual palpation, (3) The growth is advanced when there is extensive fixation on one or both sides, (4) Recurrences after operation. Using this classification, cures by surgery can be expected only in the first group, there being an operative mortality varying from 11 to 18 per cent. Using radium, the author has had no primary mortality and has had 50 per cent five-year cures in Group 1, 31 per cent five-year cures in Group 2, 9 per cent five-year cures in Group 3, and 10 per cent five-year cures in Group 4. In most of the cases under observation for less than five years there has been considerable amelioration of the disease. The author has been unable to establish any definite relationship between the histology of the growth and the response to radiation.

The author does not give his technic in detail, but he prefers radium emanation to radium salts. He does not advocate intra-uterine radiation as he fears the risk of slough and infection in the uterus. His radium containers are held around the growth by gauze soaked in water. Very large doses are given (from 3 to 4 curie hours in a single dose), so that the treatment is completed in from one to two hours. Parametrial nodes are treated by implantation with gold seeds. Hysterectomy following radiation is not advisable and the use of X-rays to the pelvis after local radium treatment does not appear to alter the prognosis. X-rays should be used only in the advanced cases as a palliative.

P J KERLEY, M.B.

Radium Injuries to Bladder and Rectum in Treatment of Cancer of Uterine Cervix F C Wille. Monatschr f Geburtsh u Gynäkol, August, 1930, LXXXV, 383-390 (Reprinted from "Cancer Review" by permission.)

The author doubts whether or not radium is often responsible for early radium injury to the bladder, because cystitis is common in advanced cancer of the cervix. The late results attributed to radium are of two kinds: grevish patches (also occurring sometimes after operation when the bladder has been freed from the adjacent tissues) and ulcers with a surrounding area of bullous edema (also at times

seen in non-irradiated cases in which there is commencing invasion of the bladder wall by the growth, i.e., a stage in perforation of the bladder).

The author describes ten cases of fistula (five vesicovaginal, three rectovaginal, two a combination of these), apparently attributable to repeated treatments rather than to single large doses. The fistulas developed within a year at most after the last treatment. These cases occurred between 1915 and 1928, during which time 386 cases were treated with radium. The author believes that with the method now used at the Charité, in which a total dosage of from 3,000 to 3,600 mg-hrs is given in two sittings with an interval of eight days, these injuries will be less frequently seen.

F CAVERS, D.Sc.

Chemical Changes Produced in Malignant Tissue by Radium Radiation and the Importance of These Changes in the Treatment of Cancer J Flaszen and H Wachtel Bull Assn franç p l'étude du Cancer, January, 1931, XX, 18-30 (Reprinted from "Cancer Review" by permission.)

The authors, having observed in certain cases of cancer treated by radium a very early reaction without any latent period, have investigated the question of chemical changes produced at the site of irradiation. They have discovered what they term a "histolytic action," provoked mostly by the beta rays of radium, which leads to a modification of the power of the malignant cells to resist destruction by the protective processes of the body. This results in an immediate decrease in the size of the malignant tumor and even, in some cases, to a complete local cure of the condition before the expiry of the latent period which precedes the appearance of effects due to the gamma rays.

C E DUKES, M.D., M.Sc.

ROENTGEN RAY (INDUSTRIAL APPLICATION)

Radiographic Inspection of Metals Herbert R Isenburger Mech Eng, 1931, LIII, 729-735

The relative value and application of X-rays and γ -rays for the inspection of metals are discussed. The X-rays are used for industrial purposes. The equipment is described and the various defects of castings and welds are demonstrated and explained by means of photographs. For very heavy material of more than 3 in thickness, γ -rays should be used, because they are more penetrating. They also give finer details in thinner materials. The operating cost with X-rays amounts to from \$3.00 to \$5.00 per hour, depending on the way in which the material is writ-

A Method of Anchoring Radium Needles in the Pharynx J E G McGibbon British Med Jour, May 16, 1931, No 3671, p 843

The technic described below has been adopted to overcome the difficulties encountered due to involuntary swallowing movements, hawking, and coughing

In all previously described methods the needles have either been sutured in position, or the threads brought out through the mouth. In this method the needles are inserted in the usual manner through healthy tissue around the lesion, and the threads are left some ten inches in length. After insertion of a needle, its thread is secured outside the mouth, without any tension, by pressure forceps. When the requisite number of needles has been introduced a soft rubber urethral catheter, lubricated with liquid paraffin, is passed along the floor of one nasal fossa into the nasopharynx. As soon as the tip of the catheter is seen below the soft palate it is caught by a pair of forceps and brought outside the mouth. Half the total number of radium needle threads are then released from the pressure forceps and tied securely to the end of the catheter. The catheter is now carefully withdrawn from the nose, and immediately the attached threads appear at the nasal orifice, they are freed from the catheter. Each thread is gently drawn taut, and during traction, observation must be kept on the site of insertion of the attached needle in order to prevent accidental withdrawal. These threads are then tied together with a piece of silk or catgut. The lubricated catheter is now passed through the other nasal fossa, and the remaining free threads are dealt with in a similar manner. Finally, the two bundles of threads are tied securely together across the columella and the redundant ends cut off.

This method can be used successfully for lesions affecting the tonsil alone, the soft palate alone, the tonsil and palate, the tonsil and side of the tongue, the tonsil, palate, and side of the tongue, and the posterior pharyngeal wall.

Nasal respiration, speech, and swallowing are not interfered with, and the patient can take ordinary soft food up to the fifth day. From the fifth to the eighth day, when the needles are removed, only liquids may be taken.

Needles 21.7 cm in length (active length 10 mm), 1.65 mm external diameter, containing 1 mg of radium screened by 0.5 mm platinum, have been found most convenient for use in the regions discussed above.

WALLACE D MACKENZIE, M.D.

On External Radium Treatment in Gastro-intestinal Ulcers and in Their Post-operative Symptoms
Fritz Dautwitz. Strahlentherapie, Oct 3, 1931,
XLII, 219-248

During the years from 1912 to 1929, the author

treated twenty-five cases with gastro-intestinal symptoms which led to a diagnosis of either ulcer or carcinoma by external radium application. A fractional dose method was used, giving exposures daily or every other day. A series consisted of from four to eleven treatments of from eight to nine hours each and from one to three series were applied. The radium was filtered through 15 mm lead and was usually given through three anterior and two posterior fields. The dose varied between 2,000 and 13,700 mg-hrs radium element. No other medication was given nor a special diet prescribed, in order to study the efficacy of the irradiation alone. There were seven cases of gastric ulcer, three of pyloric ulcer, three cases of questionable ulcer, six of duodenal ulcer, one of pylorospasm, one of hyperacidity, three of gastric and one of pyloric carcinoma. In only one case was there no response, while in four others, three of which had been operated on after radium treatment, no permanent cure could be obtained. All the remaining seventeen were benefited by the treatment, although surgical procedures had not given them definite relief from their symptoms. There follows then a lengthy discussion of the possible mechanism of the effect of irradiation on gastro-intestinal ulcers. Briefs of the twenty-five case histories are also appended. The author recommends this method for trial on a large number of patients.

ERNST A. POHLE, M.D., Ph.D.

Radium Treatment of Cancer of the Mouth. A. Santoro. Radiol Med, January, 1931, XVIII, 115-128. (Reprinted from "Cancer Review" by permission)

This is a report, with clinical histories, of eighteen cases treated for from four to twenty months. Clinical cure is claimed in twelve cases (though, of course, all are much too recent to be worth reporting). The technic varied according to the site of the tumor (contact application, external radiation with wax-modelled applicators, needling, combinations of these with X-rays, and diathermo-coagulation).

F. CAVERS, D.Sc.

Radium in the Treatment of Carcinoma of the Uterine Cervix W Neill. Med Jour and Record, 1931, CXXXIV, 74-76. (Reprinted from "Cancer Review" by permission)

The value of radium treatment for carcinoma of the cervix is now well known and the results obtained in both early and advanced cases are superior to those of any other treatment. The efforts of the American Society for the Control of Cancer have undoubtedly accomplished something towards the education of the public as regards the early symptoms of this disease. Before radium treatment is commenced a very careful examination should be

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ten off Radiographic inspection costs about the same when the radio-active material is rented

CHEMICAL ABSTRACTS

The Use of X-rays in Petrography of Bituminous Coal H Winter Glückauf, 1931, LXVII, 1105-1111

The nature and distribution of ash in pulverized coal are shown by the roentgen-ray method. An improved procedure is described in which an ionization chamber and gold leaf electroscope are used. Means are provided for accurate standardization of the ionizing current, and instantaneous readings of the rate of discharge of the electroscope are obtained by means of a Siemens charge meter. Since the nature of the ash in coal affects the degree of penetration of the rays, accurate determination of the amount of ash present is possible only when its chemical composition varies only slightly from sample to sample as is the case with different samples of coal from the same mine.

CHEMICAL ABSTRACTS

SINUSES (DIAGNOSIS)

Further Studies in the Use of Iodized Oil (Lipiodol) in the Diagnosis of Maxillary Sinus Disease, with a Report of 225 Cases E L Whitney and H P Doub Jour Michigan St Med Soc, February, 1931, XXX, 72-77

In the borderline cases, iodized oil is of greatest value in determining the type and extent of the pathology, in ascertaining anatomic variations.

With the patient in upright position, under anesthesia with 10 per cent cocaine, sinuses are injected using a 16 gauge needle for the puncture. Lipiodol is diluted with two parts petrolatum. After injection, until the oil is seen returning over the inferior turbinate, a moist piece of cotton is placed in the region of the inferior meatus and the patient sent to the X-ray Department, where films are made in all the standard positions, with progress films to check the emptying time. In the normal antrum, the opaque shadow will be the size and shape of the bony contour of the sinus, pathologic variations shown will be thickened membrane, polyps, and other

tumor growths. The emptying time is being given increasing attention.

Lipiodol examination agreed as to the presence of pathology in 96 per cent of the operated cases, while sinus washing was dependable in only 56 per cent.

W W WATKINS, M D

The Radiography of the Accessory Nasal Sinuses A New Standardized Technic for the Exact Projection of All the Accessory Nasal Sinuses, Together with the Demonstration of Fluid Levels H Graham Hodgson Brit Jour Radiol, September, 1931, IV, 421-431

Since the use of "nose-chin" or "forehead nose" positions obviously will not give constant relationship of various bony landmarks of the skull in sinus radiography, the author has resorted to the use of a specially constructed upright head clamp attached to a vertically mounted Bucky diaphragm. A large metal protractor is used for obtaining constant angles between the central ray from the tube and the orbito-meatal line.

Six positions are routinely used: (1) The occipito-frontal, with the orbito-meatal line perpendicular to the film and the rays centered over the external occipital protuberance (petrous bones thrown into orbital spaces, hence projection closely simulates the Granger position) for maxillary sinus study, (2) the occipito-mental, with the head tilted backward 45 degrees, which throws the petrous bones inferior to the antra and shows the anterior ethmoid cells projected above the posterior ethmoids, (3) the vertico-mental view, with the head tilted back to the maximum and the tube now tilted downward so that the central ray will pass exactly vertically through the vertex of the skull, for sphenoid study, (4) and (5) the right and left oblique views, with the head tilted backward 39 degrees and rotated 39 degrees to right and left, thus projecting the posterior ethmoids into the corresponding maxillary sinus, and (6) the simple true lateral.

By making all examinations with the patient sitting up, low fluid levels in the antra can be readily identified which might be entirely missed with the patient in the prone posture. (Of such cases, 5 per cent may be clinically normal antra, in the author's experience.)

J E HABDE, M D

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RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA

VOL XVIII

APRIL, 1932

No 4

THE PHYSICAL FOUNDATION OF GRENZ-RAY THERAPY¹

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ABOUT six years ago, Dr Gustav Bucky invited me to work with him on the investigation of the physical and clinical foundations of over-soft roentgen rays, which he had just introduced into practical use. We attempted to determine the wave lengths of the soft rays used by Dr Bucky and to devise practical methods of measuring the quality and quantity of these rays, publishing the results in various papers, including those in the *American Journal of Roentgenology and Radium Therapy* (1), and also in Dr Bucky's book (2).

Although considerable progress has been made in the past few years (3) in the clinical application of Grenz rays, the physical foundations have essentially remained the same. In the following presentation, therefore, some of the old data will necessarily be repeated and the few new developments will be added.

During the past few years the name "Grenz," or border, rays has been used more and more in the literature to designate roentgen-ray beams of an average wavelength of about 15 to 25 Ångstroms, or of half value layers of 0.015 to 0.03 mm of aluminum. Although from the biologic and clinical points of view the term "borderline rays" has its justification, it must be emphasized here that physically these rays form

only a small part of the large spectrum of roentgen rays which has been known for many years.

GRENZ-RAY APPARATUS

A Grenz-ray apparatus is shown in Figure 1. The main transformer, the filament transformer, and the Grenz-ray tube are contained in a separate shock-proof box (B) which is suspended on a stand and can be easily adjusted. The tube acts as its own rectifier. The switchboard (A) contains the autotransformer and resistance control, a milliammeter, a voltmeter, and also a water pump which forces water through the cooling device of the tube. One side of the transformer, usually that which supplies current to the water-cooled electrode, is grounded.

Well known European types of Grenz-ray apparatus are manufactured by Siemens-Reiniger-Veifa, of Berlin, Sanitas, of Berlin, Koch and Sterzel, of Dresden, Seifert, of Hamburg, and Sommer, of Vienna. These types are all practically the same, that is, the control board, the transformer, and the tube are all mounted on one easily movable stand.

GRENZ-RAY TUBES

In previous publications we described the commercial tubes (manufactured by C H F Muller, of Hamburg, and by Siemens-

¹Read by A. W. Erskine, M.D. for the author as part of the Symposium on the Grenz Ray before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis Nov. 30-Dec. 4, 1931

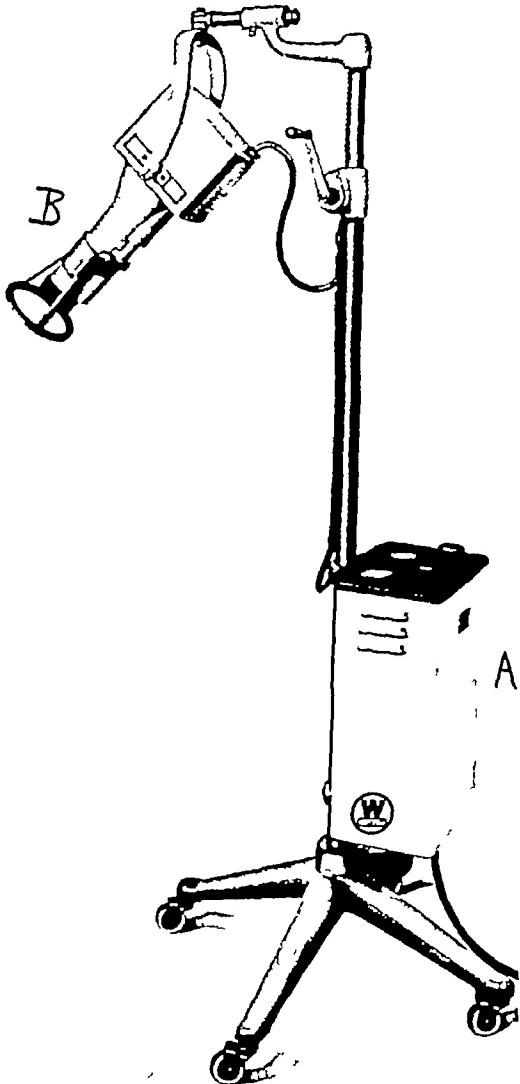


Fig 1. Westinghouse Grenz-ray apparatus. (A) switchboard, (B) transformer and Grenz-ray tube

Reiniger-Verfa, of Berlin), which are still in use to-day (Fig 2, B and C). We also described a tube made entirely of lithium glass, which was constructed in the laboratories of the Cleveland Clinic Foundation. At that time we called attention to the fact that this tube did not yet compare favorably with the commercial Grenz-ray tubes, since the transmission rate of the lithium glass used by us was less than that of the Linde-

mann glass used in the commercial tubes. We, therefore, abandoned the construction of lithium glass tubes and turned to another method in which we attempted to avoid the use of the Lindemann window. It must be remembered that the materials of which the Lindemann window is composed, namely, boron, beryllium, and lithium, are of low atomic weight and, therefore, easily permit the transmission of very soft rays. On the other hand, the Lindemann window must be rather thin (about 0.3 mm.) and, since it is slightly hygroscopic, it is not stable. Since it deteriorates in time unless it is carefully protected by a covering of lacquer, an attempt was made to obtain the same radiation transmission with a more stable window. Following the idea of the thin glass window used by Slack in his cathode-ray tube, we built a Grenz-ray tube with the same type of window (4). The tube itself, with the exception of the window, is built on the same principles as that made by the C H F Muller Company (Fig 3). The window is a very thin bubble of glass which is drawn into a larger glass sphere. According to our tests, the filtering action is about the same as that of the Lindemann window of the Muller tube, but the glass window is more stable and does not deteriorate with time. This construction easily prevents damage to the window and also offers good resistance to the atmospheric pressure.

Shortly after the construction of our tube and the publication of our article in *Strahlentherapie*, an advertisement of the Westinghouse X-ray Company appeared in the *Journal of the American Medical Association* (June 1931, XCVI, 7), describing a new Grenz-ray tube, built on the same principle as ours, on which scientists of the Westinghouse X-ray Company had been working independently for some time. This Westinghouse Grenz-ray tube (Fig 4), the Siemens, and the Muller tubes are the only commercial Grenz-ray tubes on the market at the present time.

SPECTRUM OF GRENZ RAYS

Grenz rays are roentgen rays of a wave length in the neighborhood of 2 Å U, which are produced by the special tubes just described. Because of the low potential used

Grenz rays produced at various voltages as calculated by Kustner (9) are shown in Figure 5. Additional spectral distributions of Grenz-ray beams have been reported elsewhere (1, 2, 6, 9). It is interesting to study the spectral distribution as well as the

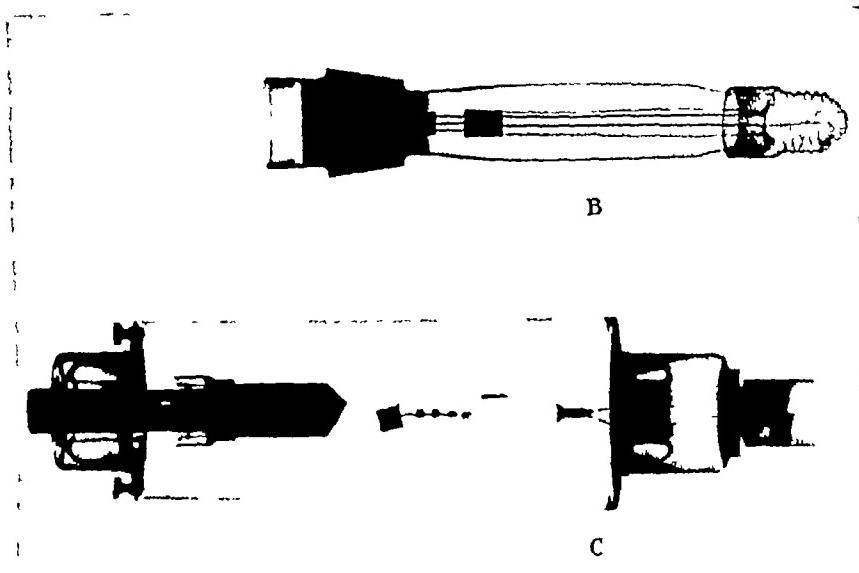


Fig 2 (B) Müller Grenz-ray tube, (C) Siemens Grenz-ray tube

(around 10 KV), the spectrum is limited to about 1 Å U at the short wave end. These short wave lengths have very characteristic properties, described in detail in earlier publications (1-8), which are important in therapy and must be discussed briefly here.

As Grenz rays are extremely soft, their quality and quantity depend very much upon the thickness of the glass or Lindemann glass window, and also upon the layer of air between the tube and the skin, or measuring instrument. The spectral distribution of the Grenz-ray beam, and therewith its quality, on the one hand, will change with various thicknesses of windows and with various focal skin distances, the relative intensities of Grenz-ray beams, on the other hand, will not follow the law of inverse squares of distance.

Curves of the spectral distribution of

rapid decrease in intensity for decreasing voltages. The absorption of Grenz rays in a Lindemann window and in air can be calculated for various wave lengths by means of the following formula (9)

$$\mu_{\text{air}} = 0.00331 \lambda^3 + 0.00022$$

$$\mu_{\text{Lindemann}} = 5.0 \lambda^3 + 0.04$$

where μ is the coefficient of absorption and λ the wave length in Ångstroms. These absorption coefficients permit the calculation of the absorption of the window and of air for various wave lengths.

TABLE I

| K.V | Thickness of Lindemann windows in millimeters | | |
|-----|--|-------|-------|
| | 0.04 | 0.20 | 0.40 |
| 6 | 40.7 | 0.074 | 0.013 |
| 8 | 118.0 | 34.3 | 0.14 |
| 10 | 256.0 | 100.0 | 49.2 |

These data show the great influence of the thickness of the tube window and air

layers upon the qualitative and quantitative distributions of the rays. It follows, therefore, that in order to obtain a correct estimate of the quality and quantity of Grenz rays at a given point, for instance, for the application of a certain dose, it is necessary that this determination be made at the point of the application of the rays. We shall, therefore, employ the half value layer in aluminum to indicate the radiation quality, and the number of roentgen units per minute to indicate the intensity of the radiation. In addition we shall specify the kilovoltage,

stated, it is advisable to supplement the direct method of determination of quality

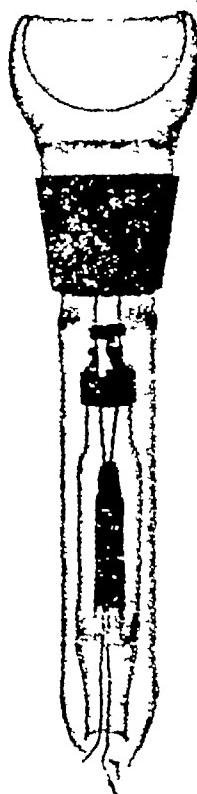


Fig. 3 Grenz-ray tube with Slack window

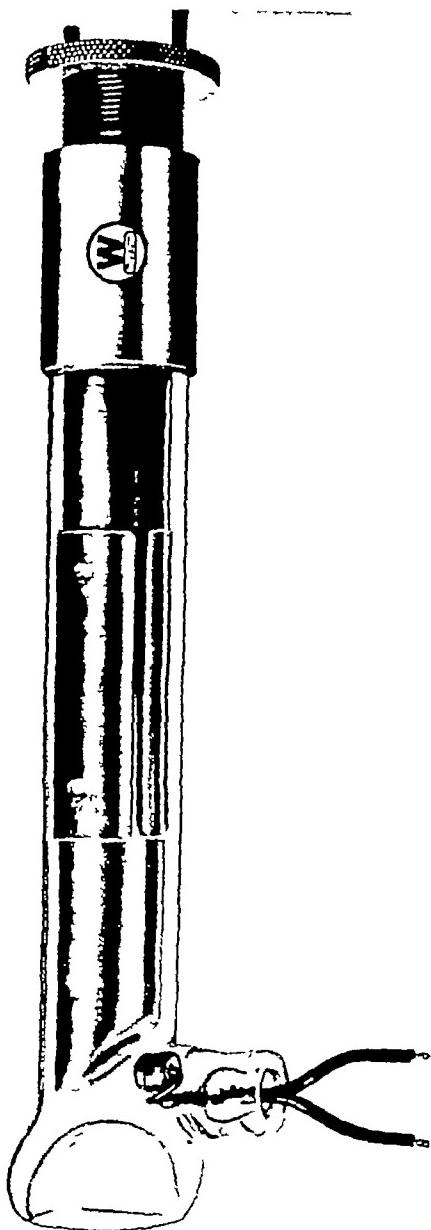


Fig. 4 Westinghouse Grenz-ray tube

the milliamperage, the tube, the target material, and the focal distance.

DETERMINATION OF QUALITY OF GRENZ RAYS

(A) *Indirect Method*—As we have just

by the so-called indirect method, which consists in giving the secondary voltage and current and specifying the tube, target material, and focal skin distance used. The switchboards of all types of Grenz-ray

apparatus mentioned above are equipped with a kilovolt meter, that is, a voltmeter which is connected across the primary of the transformer. The voltmeters are calibrated in kilovolts in the factory by various methods. Whenever feasible, it is advisable

gap. In order to avoid mistakes, secondary voltages should always be given in peak and not in effective voltages. The secondary current is read on a milliamperemeter which is also mounted on the switchboard of the Grenz-ray apparatus.

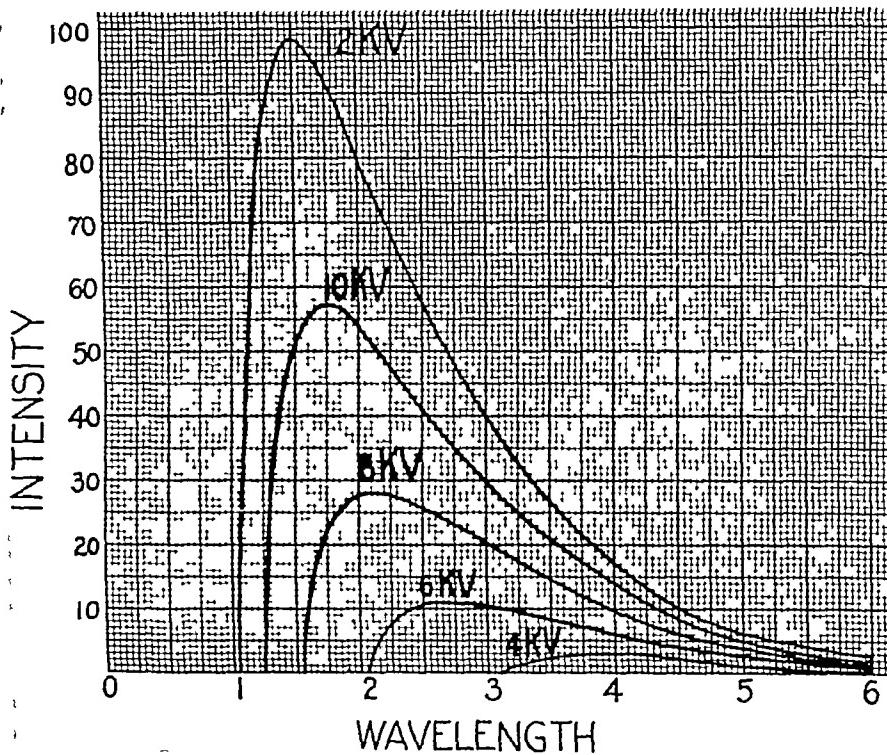


Fig 5 Spectrum of Grenz-ray beams produced at various voltages (Kustner)

to recalibrate these meters from time to time by means of sphere gaps or spark gaps. Better than sphere gaps are electrostatic voltmeters which are reliable and can be easily procured for the voltages used in Grenz-ray therapy. It is not sufficient, however, to connect the gap right across the terminals of the Grenz-ray tube since in practically all Grenz-ray apparatus the negative phase of the current is not suppressed. This negative phase usually is higher than that which reaches the tube and must, therefore, be excluded by means of a valve tube which must be included in the secondary circuit connected in series with the sphere

(B) *Direct Method*—In addition to the data described in the preceding paragraphs it is advisable to indicate the radiation quality by direct means. A number of years ago we suggested the use of the half value layer in aluminum to specify radiation quality in Grenz-ray therapy. This half value layer can be determined satisfactorily by means of the ionization dosimeter which will be described later. In our measurements we used pure aluminum foil of 0.0125 mm thickness as an absorbent material. Cellophane, as well as other substances, has been suggested for this purpose. We found, however, that aluminum was supe-

rior to other materials since it can be obtained in uniform thickness and does not show the variations in absorption due to impurities or irregularities in composition inherent in most other materials. Further-

from the focus to the chamber. For the sake of comparison, in addition to the curves obtained with the Muller Grenz-ray tube at 4, 5, 6, 8, 10, and 12 K.V., an absorption curve is illustrated which is ob-

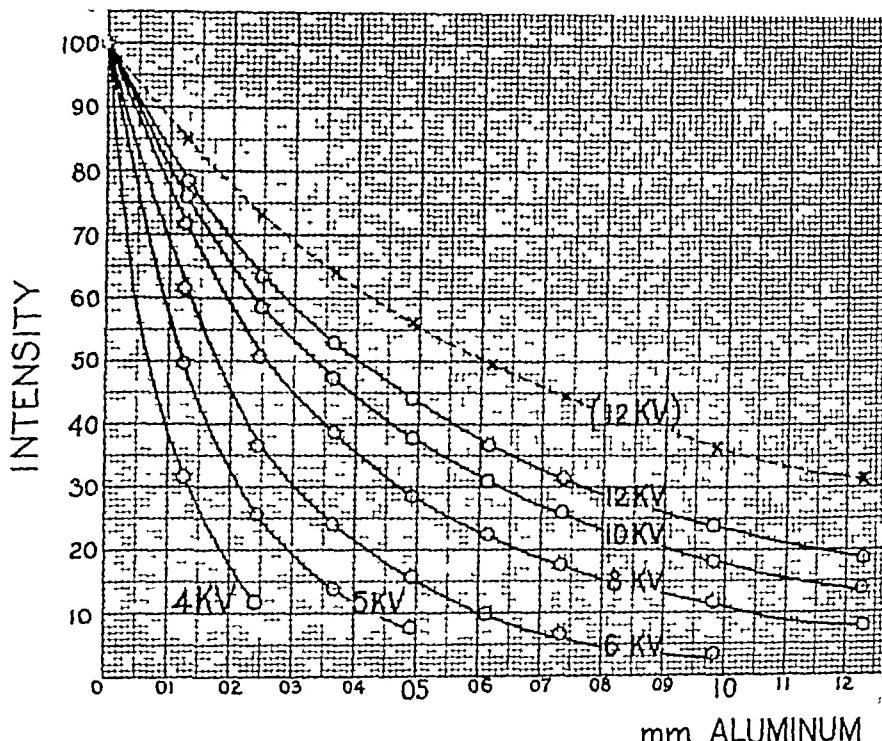


Fig 6. Absorption curves for Grenz rays produced at various voltages.

more, some of the other materials are hygroscopic and, therefore, change with time.

Complete absorption curves on Grenz rays produced at various voltages have been described (1, 2), and the more important data are again reproduced (Fig 6). The various intensities were measured with a specially constructed ionization chamber, made of goldbeater's skin and having a volume of 1 cubic centimeter. This chamber measures the radiation intensity independently of the wave lengths over the range used in Grenz-ray therapy. The curves were obtained with a Muller tube, the distance from the window to the chamber being 4 cm, that is, 9.6 cm

tained by means of an ordinary Coolidge tube operated at 12 kilovolts. As we have stated, these curves hold only for the special tubes with which they have been measured; they may be quite different for other tubes. Furthermore, the quality distribution measured would be different if the measurements had been made at greater distances since the air would act as a filter and "harden" the Grenz-ray beams. We have previously discussed this effect and further extensive experimental data regarding it were recently presented by Meyer (10), using filters of 0.01, 0.013, 0.018, 0.025, 0.031, and 0.035 mm aluminum and a Sie-

mens integral dosimeter with a Grenz-ray chamber. This author also called attention to the fact noticed by others (3, 6, 11) that, due to the filtering effect of the sputtered tungsten on the window of the tube, Grenz-ray tubes harden with use. For this reason, it is necessary to repeat dosage measure-

ments on Grenz-ray tubes at least after every 100 hours of use.

It must be mentioned here that some authors believe that the half value layer method of indicating radiation quality for Grenz rays is not necessary, and that indirect factors indicating the quality are

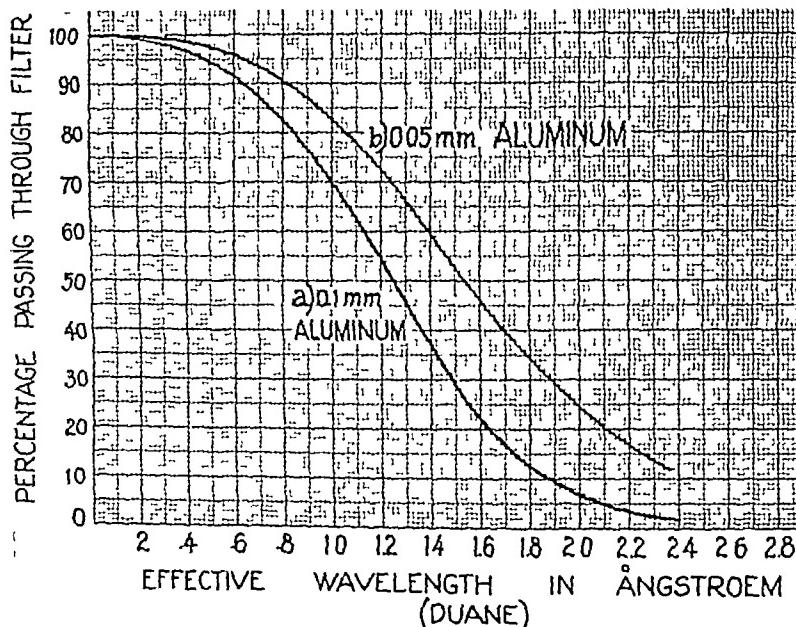


Fig 7 Curves for the determination of the effective wave length for Grenz rays (Duane)

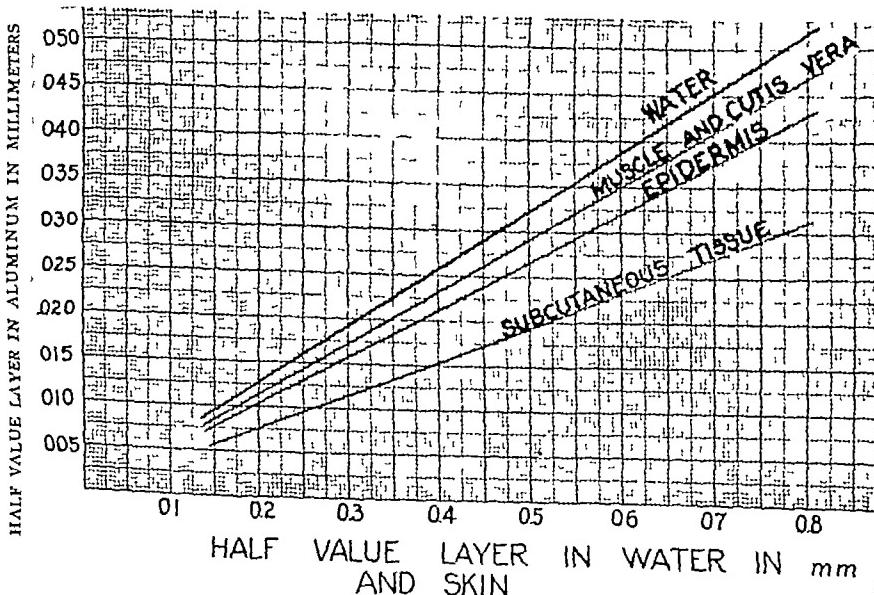


Fig 8 Half value layer in aluminum as opposed to half value layer in water and various parts of the skin

entirely sufficient. However, on this point opinions are divided and controversies have arisen (12).

Berger (13), who at first was against the use of the half value layer, has since con-

tinued to use it and has recommended it as directly calibrated in respective thicknesses. In our opinion, the determination of the half value layer is indispensable in Grenz-ray therapy.

Another method of indicating radiation quality is the effective wave length method suggested by Duane (14). This has also been discussed previously and various data have been reported (1, 2) on the effective wave lengths of Grenz-ray beams (Fig 7). We shall, therefore, not go into this question again especially since, in 1931, the International Standardization Committee at the Third International Congress of Radiology suggested that the roentgen-ray beams be characterized by the half value layer.

ABSORPTION OF GRENZ RAYS IN THE HUMAN SKIN

Formerly we presented half value layers for various layers of the human skin in combination with the half value layer in water and aluminum. The most important data in this connection are contained in Table II, which gives an idea as to how far the Grenz rays of various half value layers penetrate into the skin (Fig 8).

TABLE II—HALF VALUE LAYER IN ALUMINUM AS COMPARED WITH HALF VALUE LAYERS IN WATER, MUSCLE, CUTIS VERA, EPIDERMIS, AND SUBCUTANEOUS TISSUE (IN MILLIMETERS)

| Alu minum | Water | Muscle, cutis vera | Epi- dermis | Subcu- taneous tissue |
|--------------|-------|--------------------------|----------------|-----------------------------|
| 0.007 | 0.12 | 0.13 | 0.14 | 0.20 |
| 0.0125 | 0.20 | 0.22 | 0.24 | 0.33 |
| 0.0175 | 0.28 | 0.31 | 0.34 | 0.46 |
| 0.0250 | 0.39 | 0.43 | 0.47 | 0.64 |
| 0.0335 | 0.52 | 0.57 | 0.62 | 0.86 |
| 0.0400 | 0.62 | 0.68 | 0.74 | 1.02 |

It is interesting to compare the absorption of the Grenz rays in skin with that of roentgen rays usually employed in dermatology.

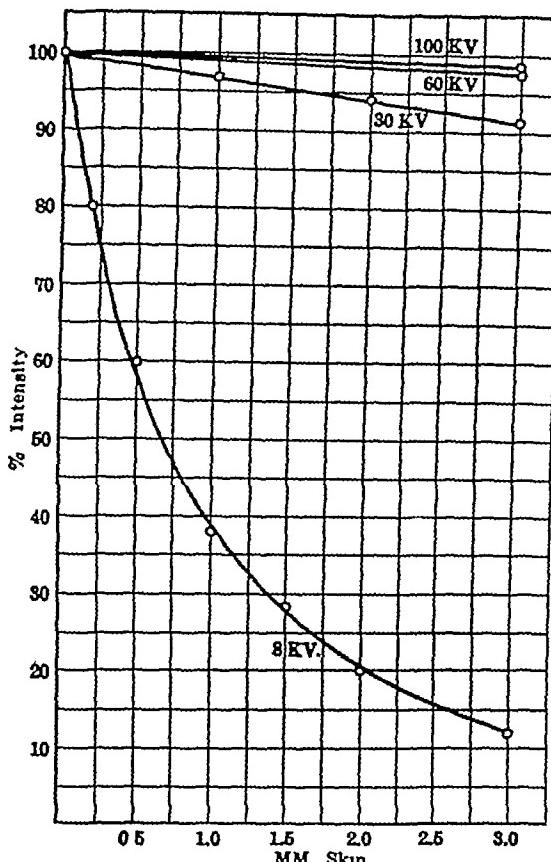


Fig 9. Comparison of the absorption of Grenz rays and harder roentgen rays in the skin.

structed a practical little apparatus to measure it. The apparatus consists of an aluminum foil of 0.01 mm thickness which can be rotated around its axis in a small cylinder, the latter being placed between the Grenz-ray tube and the ionization chamber. The Grenz rays, which first pass through a small diaphragm, must penetrate different thicknesses of aluminum foil, depending upon the angle between the foil and the path of the rays. A pointer connected to the foil permits the reading of the angle on the outside of the apparatus on a scale which

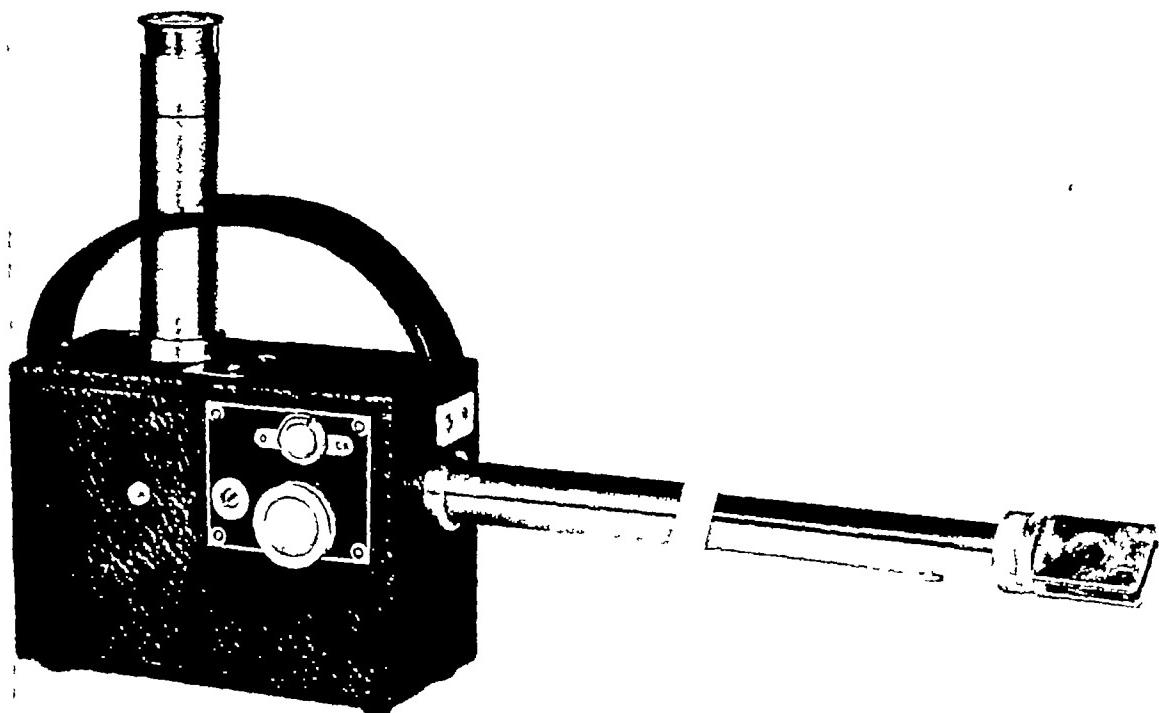


Fig. 10 Victoreen r meter with Grenz-ray chamber

Only a very low percentage of roentgen rays produced at about 100 KV are absorbed by 1 mm of skin, while over 50 per cent of Grenz rays produced at 10 KV are absorbed by 1 mm of skin. This is illustrated in Figure 9, taken from Bucky's book (2).

DETERMINATION OF THE QUANTITY OF GRENZ RAYS

(A) *Indirect Method*—The indirect method of measuring the quantity of Grenz rays by means of the milliamperemeter has been found to be unsatisfactory. The intensity delivered by various tubes for the same number of milliamperes varies widely. The Grenz-ray apparatus also must be calibrated at various voltages for various milliamperages, since the secondary current changes if the voltage is changed. It is, therefore, advisable always to use the same milliamperage for a given voltage. It is still better, however, to measure the quantity

of radiation by the direct method at the point of application.

(B) *Direct Method*—The quantity of Grenz rays is best determined by, and expressed in, the international roentgen unit, the definition of which, as well as the methods of determination, has been described frequently. A few years ago we modified our apparatus for the determination of the r unit in order to use it for the soft Grenz rays (1). Since that time we have calibrated in roentgen units specially constructed dosimeters with small ionization chambers and our calibration compares favorably with that of others. Originally we used 1 cc chambers built entirely of goldbeater's skin. However, we found that this construction was not stable enough for practical purposes and changed to a small metal ionization chamber with windows of goldbeater's skin (Fig. 10). It may be used in connection with any dosimeter, in the illustration, for instance, it is

connected to a Victoreen r meter. This instrument has proven to be very practical and satisfactory for dose measurements with Grenz rays as well as with roentgen rays, since the intensity of Grenz rays may be

employed, all absorption measurements described above, and the dose measurements to be described later, were made by means of our calibrated goldbeater's skin chamber. Photographic films have been suggested

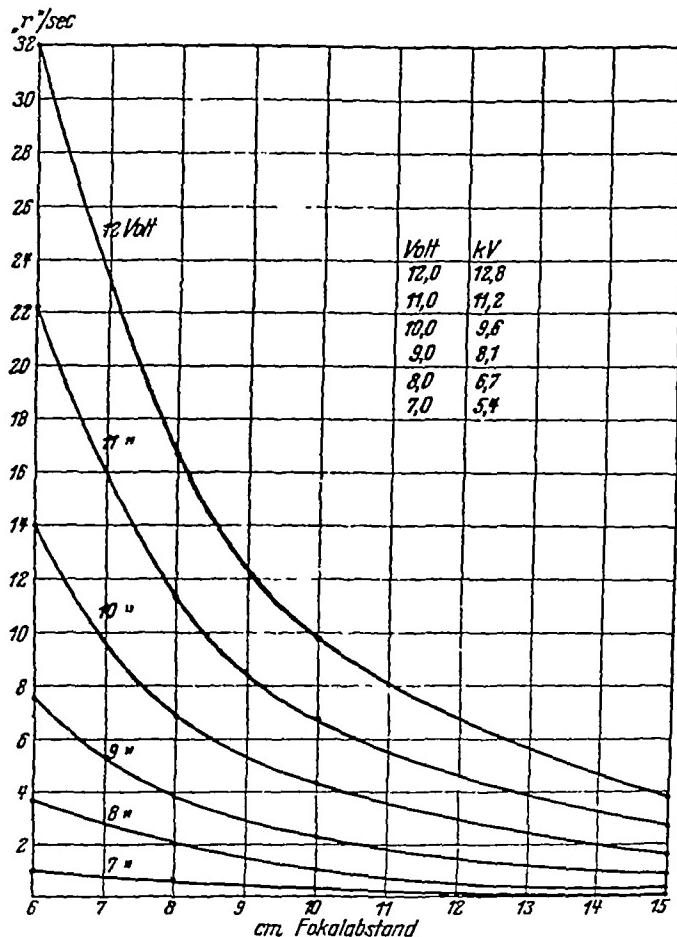


Fig. 11. Intensity of Grenz-ray beams produced at various voltages for various focal skin distances (Meyer)

measured at the point of application of the rays.² Similar instruments have been constructed by Kustner, in Gottingen, by Siemens, in Berlin, and by Strauss, in Vienna.

Since it was found to be sufficiently accurate on account of its independence of the wave lengths within the range of Grenz rays

for dosage measurements in Grenz-ray therapy (15), but the difficulties involved would seem to be too great to permit of accurate results. This observation is borne out by a controversy between the originators of the method and Reisner (16). Another dosage method which we have used with good success is the photometer (17). Packard (18) uses the death rate of

²Courtesy of the Victoreen Instrument Company, Cleveland, Ohio

Drosophila eggs to measure biologically the intensity of Grenz rays Thaller (19) recently suggested a new method making use of a specially constructed photo-electric cell

DOSE MEASUREMENTS ON GRENZ RAYS IN PRACTICAL USE

In his latest papers, Bucky suggests the use of Grenz rays of half value layers of

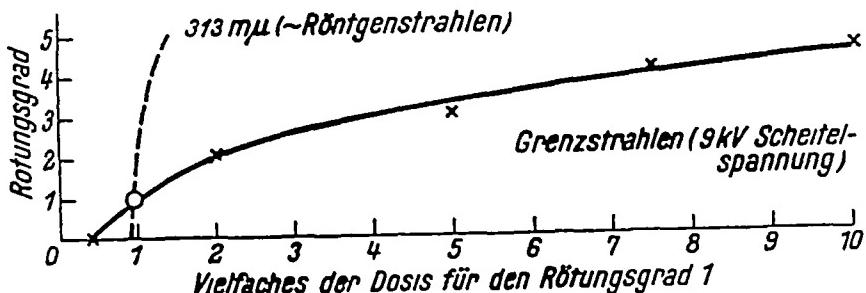


Fig 12 Comparison of the degree of redness of the skin after application of increasing doses of roentgen rays and of Grenz rays (Hausser and Schlechter) Rotungsgrad degree of erythema Vielfaches der Dosis für den Rötungsgrad I multiple of the dose to produce one degree of erythema

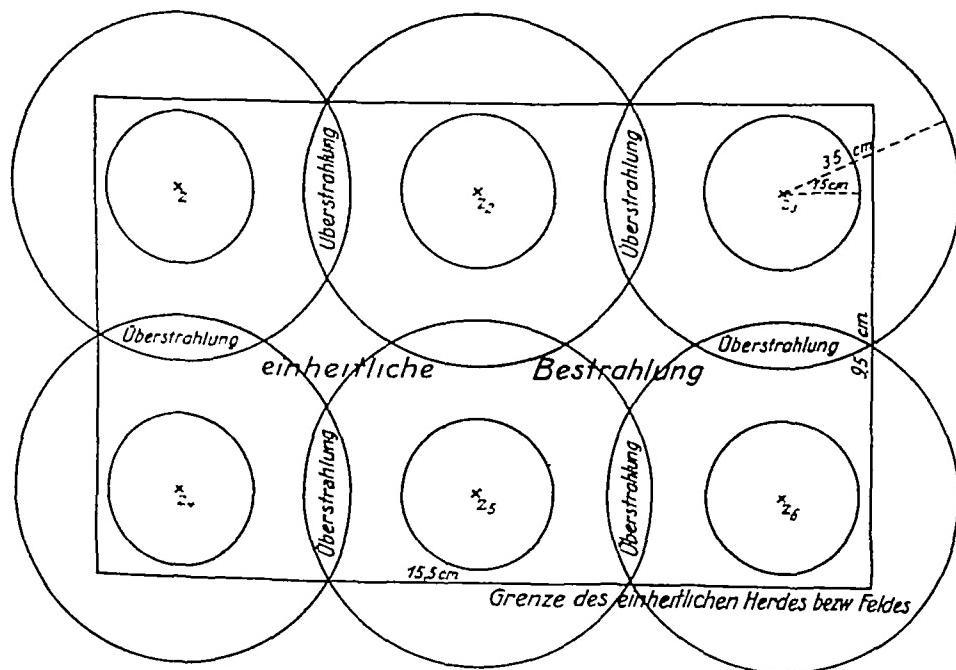


Fig 13 Mapping out a large area of irradiation by combining various Grenz-ray beams

for the measurement of Grenz rays. In making these intensity measurements on Muller Grenz-ray tubes which have a ring-shaped focus, special precautions must be taken in order to avoid errors (20).

0.015 to 0.03 mm of aluminum and focal skin distances from 6 to 15 centimeters. In Table III we have collected a series of data on Grenz-ray qualities for various conditions from which it will be seen that the

connected to a Victoreen r meter. This instrument has proven to be very practical and satisfactory for dose measurements with Grenz rays as well as with roentgen rays, since the intensity of Grenz rays may be

employed, all absorption measurements described above, and the dose measurements to be described later, were made by means of our calibrated goldbeater's skin chamber. Photographic films have been suggested

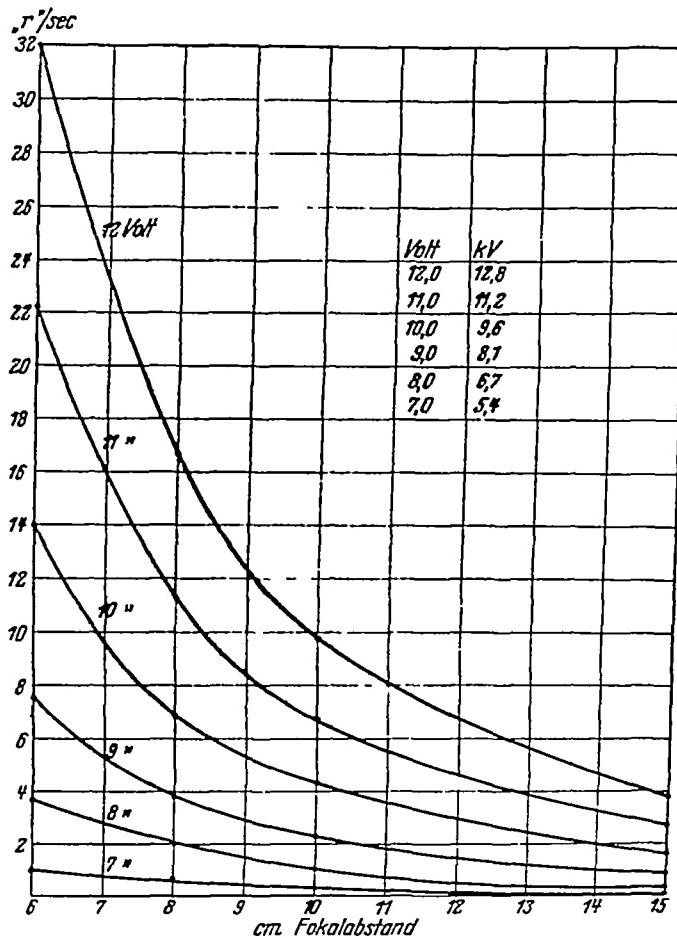


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²Courtesy of the Victoreen Instrument Company Cleveland, Ohio

to a considerable degree, therefore, only direct determinations of the radiation quality and quantity at the site of application are found to be satisfactory. These data should be accompanied preferably by an indication of the kilovoltage, the milliamperage, the type of tube, the target material, and the focal skin distance.

The absorption of Grenz rays in aluminum foil of 0.125 mm thickness has been determined for different conditions of radiation and the half value layers of this radiation are found to be between 0.04 and 0.01 mm of aluminum.

Data for translating half value layers of aluminum into half value layers of air, water, muscle, and various parts of the skin are given.

A small ionization chamber of goldbeater's skin, which is practical for dosage measurements in Grenz rays and is calibrated in roentgen units, is described. This chamber may be connected to any ionization dosimeter and the radiation intensity of Grenz rays may be measured independently of the wave lengths over the range used in Grenz-ray therapy. By means of this goldbeater's skin chamber the intensity of Grenz rays has been measured in r per minute for a number of radiation conditions, having been found to vary between about 400 r per minute and 0.5 r per minute.

The threshold erythema dose for Grenz rays is in the neighborhood of 250 r units. The increase of the physiologic effect of Grenz rays upon the skin with increasing dosages is much smaller than it is for roentgen rays.

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qualities suggested by Bucky were produced with our tubes at voltages of from 6 to 10 kilovolts

TABLE III—HALF VALUE LAYER IN MILLIMETER ALUMINUM FOR GRENZ RAYS, MULLER TUBE, CHROMIUM IRON TARGET, 10 MILLIAMPERES

| KV | 4 cm distance (window chamber), millimeter | 20 cm distance (window chamber), millimeter |
|----|---|--|
| 4 | 0.007 | ----- |
| 5 | 0.0125 | ----- |
| 6 | 0.0175 | 0.0195 |
| 8 | 0.0250 | 0.0315 |
| 10 | 0.0335 | 0.0435 |
| 12 | 0.0400 | 0.0610 |

In Table IV are presented various Grenz-ray intensities in roentgen units

Figure 11 shows more data on Grenz-ray intensities for various focal distances and various voltages as published recently (10). The data show that the intensity decreases rapidly with decreasing kilovoltage and increasing distances. We have stated previously (1, 2) that it is difficult to fix erythema doses for Grenz rays and have made the suggestion that the value of 250 r units be accepted as a threshold erythema dose. Further experiments have shown that this value is approximately correct. Haussner and Schlechter (21) presented data on measurements of erythema doses with Grenz rays as compared to erythema doses produced with roentgen rays and have shown that the increase in the biologic reaction with increasing doses is much slower for Grenz rays than for X-rays (Fig. 12). Finally, attention must be called to the difficulty in radiating larger skin areas with the ordinary type tube, since at 4 cm distance the diameter of the irradiated area is only about 4 centimeters, and there is a marked decrease in intensity in this area from the center toward the periphery. For practical treatments careful planning (22) of the combination of various areas has to precede

the treatment for a typical case this is illustrated in Figure 13.

TABLE IV—RADIATION INTENSITIES IN R/MIN AND ERYTHEMA TIMES PER DOSE OF 250 r FOR DIFFERENT DISTANCES MÜLLER TUBE, 10 MILLIAMPERES

| Distance in cm (window chamber) | 6 KV radiation | | 10 KV radiation | |
|--|----------------|---|-----------------|---|
| | r/min | Erythema time in minutes for 250 r | r/min. | Erythema time in minutes for 250 r |
| 4 | 47.2 | 5.3 | 396.0 | 0.6 |
| 6 | 27.6 | 9.0 | 239.0 | 1.0 |
| 8 | 18.2 | 13.7 | 162.0 | 1.5 |
| 10 | 12.7 | 19.7 | 126.0 | 2.0 |
| 15 | 5.9 | 42.3 | 66.5 | 3.8 |
| 20 | 3.2 | 78.0 | 42.5 | 5.9 |

RADIATION INTENSITIES AND ERYTHEMA TIMES PER DOSE OF 250 r FOR DIFFERENT POTENTIALS MÜLLER TUBE, 10 MILLIAMPERES

| E.m.f., KV | 20 centimeters distance window chamber | | 4 centimeters distance window chamber | |
|---------------|--|---|---|---|
| | r/min | Erythema time in minutes for 250 r | r/min | Erythema time in minutes for 250 r |
| 5 | 0.54 | 463.0 | 10.5 | 23.8 |
| 6 | 3.2 | 78.0 | 47.2 | 5.3 |
| 8 | 16.8 | 14.9 | 195.0 | 1.3 |
| 10 | 42.5 | 5.9 | 396.0 | 0.6 |
| 12 | 98.5 | 2.5 | 7100 | 0.35 |

SUMMARY

Grenz rays are soft roentgen rays having a wave length of from 1 to 3 Ångstrom units. They are produced in tubes with Lindemann glass or specially constructed windows of ordinary glass with voltages of from 6 to 10 kilovolts.

High tension apparatus and tubes for the production of Grenz rays are described.

Grenz rays are so soft that they are absorbed in the window of the tube and air

to a considerable degree, therefore, only direct determinations of the radiation quality and quantity at the site of application are found to be satisfactory. These data should be accompanied preferably by an indication of the kilovoltage, the milliamperage, the type of tube, the target material, and the focal skin distance.

The absorption of Grenz rays in aluminum foil of 0.125 mm thickness has been determined for different conditions of radiation and the half value layers of this radiation are found to be between 0.04 and 0.01 mm of aluminum.

Data for translating half value layers of aluminum into half value layers of air, water, muscle, and various parts of the skin are given.

A small ionization chamber of goldbeater's skin, which is practical for dosage measurements in Grenz rays and is calibrated in roentgen units, is described. This chamber may be connected to any ionization dosimeter and the radiation intensity of Grenz rays may be measured independently of the wave lengths over the range used in Grenz-ray therapy. By means of this goldbeater's skin chamber the intensity of Grenz rays has been measured in r per minute for a number of radiation conditions, having been found to vary between about 400 r per minute and 0.5 r per minute.

The threshold erythema dose for Grenz rays is in the neighborhood of 250 r units. The increase of the physiologic effect of Grenz rays upon the skin with increasing dosages is much smaller than it is for roentgen rays.

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Electron Particles Again Break up into Waves—Repetition by a modified method of the epoch-making experiments which first proved that electrons can behave as waves, has been reported by Dr C J Davisson and Dr L H Germer, who won fame some years ago by their pioneering experiments

A stream of electrons moving at high speeds was directed at a nearly glancing angle towards an etched metal surface, and caught on a photographic plate where the diffraction rings formed showed that the electrons behaved like light waves. Previously untried metals and a new method devised by Prof G P Thomson, of the Imperial College of

Science and Technology, in London, were used in the recent experiments. Patterns of about twenty rings were obtained in the new experiments of Dr Davisson and Dr Germer from the metals gold, tungsten, molybdenum, cobalt, nickel, chromium, and platinum. The arrangement of the rings was characteristic of the known structure of the metals.

For some metals, etching with acid or standing in the air caused a change in the pattern.

A narrow pencil of light rays directed at a fine grating or a pencil of X-rays hitting a crystal surface produce similar "diffraction" patterns, it was explained, because of their wave-like nature.—*Science Service*

TREATMENT OF SUPERFICIAL FUNGUS INFECTIONS WITH THE LONG WAVE LENGTH ROENTGEN RAYS (GRENZ RAYS) FURTHER OBSERVATIONS¹

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INTRODUCTION

THE prevalence of the superficial fungus infections (ringworm) is now generally recognized, even to the extent of being accorded second place (1) in the order of incidence of the most common skin diseases. This steady increase in prevalence during the past few years has been considered by many to be apparent only because of our better knowledge of the disease, and, as a result, our greater skill in recognizing its characteristics. However, a careful survey of the statistics from various countries is rather convincing proof that this increase is actual.

The increasing recognition of the importance of the superficial fungus diseases has stimulated research and observation in all of its clinical and laboratory phases, resulting, with the exception of therapy, in numerous valuable advances. Every dermatologist in particular, and every clinician in general who treats these cases, has his own favorite remedy, with the result that innumerable drugs, almost every available therapeutic physical agency, and various combinations of different methods have met with but partial success, which has tended to reveal the refractoriness to treatment of this disease.

The rapidly accumulating literature on Grenz-ray therapy, even up to now, has failed to reveal any concerted effort in the treatment of these infections, regardless of the fact that they are primarily localized in the epidermis and that most of the radiation of Grenz rays is absorbed by the epi-

dermis and upper layers of the derma. It was felt that, if Grenz rays offered any possibilities in dermatology, one excellent opportunity to determine their possibilities was in this particular field, and so it was decided to give Grenz-ray therapy a thorough clinical trial.

ETIOLOGIC ASPECTS

Research into the etiologic aspects of the superficial fungus infections has revealed the fact that the manifold cutaneous expressions may be the result of the action of all three classes of micro-organisms, *Hypomyces*, yeasts, and bacteria (2), with the yeast assuming as much importance as the others.

Efforts to classify fungi satisfactorily have resulted in considerable confusion, different workers often using different bases. Therapy has suffered as a result of this, for a simple classification based on the major morphologic characteristics might be of far greater value to the clinician and lead to better therapeutic results.

For practical purposes we have classified the fungi into two groups, namely, *Hypomyces* and yeast-like fungi. In the latter group, hyphae, which usually are of the round-cell yeast structure, may be present both microscopically and in culture. This classification is used advisedly, for Draper (3) has demonstrated that the yeast forms will grow mycelia by certain changes in the media.

Predisposing factors in these fungus infections have attained a position of importance, as is reflected by the special attention given them. Hyperhidrosis is now gen-

¹Read by Dr. M. Dorne as part of the Symposium on Grenz-ray Therapy before the Radiological Society of North America, at the Seventeenth Annual Meeting in St. Louis Nov. 30-Dec. 4 1931

erally admitted as an important predisposing factor, Levin and Silvers (4) obtaining cultures of apparently pathogenic fungi from the sweat in five of eight cases. As pre-existing intertrigo and plantar dysidrosis may predispose to infection with fungi, these possibilities must not be overlooked in therapeutic management. A much disputed point at present is the possible etiologic relationship of yeast forms in various types of dermatitis. One of us (5) has performed a series of successful inoculations of fungus cultures on their respective hosts, indicating a possible pathogenesis in the syndrome known as seborrheic dermatitis, especially of the exudative type and in certain types of infantile eczema.

X-RAY RESULTS AND ATTENDANT DANGERS

Practical skin therapy with X-radiation has been developed by dermatologists such as Sabouraud, Pusev, MacKee, and others. If the radiation is judiciously applied, it is an extremely useful agent in dermatologic practice, being now considered by many as the most useful and successful single remedy available for the treatment of skin diseases. While it is true that X-radiation has proven itself almost specific in the treatment of various cutaneous disorders, it has failed almost completely in others. It cannot be considered a panacea for all skin diseases.

Superficial fungus infections have proven themselves even more refractory to irradiation than to other forms of therapy. Occasionally the infection is permanently cured, very often after the subsidence of the acute symptoms no further improvement is noted, and recurrences are common. It is more or less generally agreed that the majority of the cases will do better under intelligent antiparasitic treatment than under irradiation. Nevertheless, X-radiation is often of value as an adjuvant.

According to MacKee (6), dermatomycosis of the acute vesicular or vesicopustular

and chronic intertriginous types responds much better to properly administered dermatologic treatment. While this is also true of the hyperkeratotic type, some cases do very well under fractional X-ray treatment. Fractional doses are advisable because

(a) Inflamed tissue is hypersensitive to X-rays

(b) The susceptibility is increased by the previous use of strong topical remedies

(c) It has been found that, if the eruption will yield to X-rays, it will respond to small doses.

If the eruption does not disappear as a result of such treatment over a period of from four to six weeks, it is unlikely to be favorably influenced by further treatment.

Filtered radiation is not believed to be more efficacious than are unfiltered X-rays.

EXPERIENCES WITH THE GRENZ RAYS

As stated in our previous communication (7), we employed a special generator for long wave length roentgen rays, designed by the General Electric X-ray Corporation, which delivered a maximum of 12 KV and 12 milliamperes. This was used to activate a specially constructed modified Coolidge tube, made by Muller of Hamburg, in which the Lindemann glass window was situated on the under surface, the entire tube being encased in a metal water jacket.

With this particular apparatus we were able, within twenty-four hours, to produce a mild red blush on the flexor surface of the forearm of a young brunette adult, employing the following factors: 8 KV, 6 ma, 3 inch skin-tube distance, and one minute exposure.

Having determined the erythema dose with our particular apparatus (8 KV, 6 ma, 3 in., 1 min.), we decided to use the fractional method of treatment, adopting one erythema dose as a working unit. Treatments were divided into one-quarter units, or fraction thereof, given at weekly intervals, four treatments constituting a

series. This method of procedure was decided on in view of the fact that we had limited our work to the treatment of the superficial fungus infections. We used such fractional doses at weekly intervals, so that there could hardly be any question as to the safety of the dosage. A few cases have been demonstrated by several dermatologists in which damage to the skin has been produced by erythema doses of Grenz rays. In cases in which large areas were involved, necessitating repeated focusing at each treatment, the dosage was reduced one-half. In several instances, as in the treatment of the nails, the dosage at each treatment was doubled.

In several of our patients, a single one-quarter unit exposure provoked a reaction which was manifested by an aggravation of the original lesions. In most instances these reactions subsided spontaneously within forty-eight hours with a resultant improvement in the lesions. In one instance, the reaction occurred after the second treatment, the first treatment apparently having improved the condition. As the dosage employed in the treatment of all these patients was identical, it would seem that the reactions induced were the results of individual tolerance.

In several instances following a series of treatments, there were recurrences of the original lesions. These were always milder than the original condition and responded promptly, as a rule, to the one or two additional treatments.

The first patient treated was a male, 33 years of age, who had a tinea cruris of five years' duration. The lesion disappeared entirely with one treatment of a quarter unit to each area. The next three cases failed to respond, even after three treatments had been administered. At this point in our investigation, a complete check-up of our apparatus was made, revealing the fact that our machine was functioning properly. Following this experience it was decided

that a clinical diagnosis alone was not sufficient indication for this type of treatment and routine smears (the extemporaneous potassium hydroxide preparation) and cultures (Sabouraud's dextrose media) were included in every case. As a result of this routine examination we soon learned that the cases which were positive for *Momilia* and yeast-like fungi responded with good results, while those in which the infections were of hyphomycetic origin showed very little, if any, improvement.

In our original communication (7) we reported 30 cases, to which we now wish to add 22 more. In this latter group our experience has been identical with that in the former group reported.

Two of the patients in this latter group exhibited erosio interdigitalis blastomycetica, the lesions in both instances involving the third interspace on both hands. Potassium hydroxide preparation and cultures revealed yeast. In one instance, topical applications consisting of 0.5 per cent methyl-violet aqueous solution was applied to the lesion on one hand once a week and a 0.25 unit of Grenz ray was given to the lesion on the other hand once a week. It was very interesting to note that improvement occurred in the lesions after two treatments by both methods, the improvement being somewhat more marked in the lesions treated by topical applications.

However, in this connection, the important observation was the fact that yeast was recovered from the lesions and there was a prompt response to therapy. In our original communication we reported an instance of a woman, aged 59 years, with similar lesions, in whom the potassium hydroxide preparation revealed large branching hyphae, but cultures were negative. In this case there was no improvement after four 0.25-unit treatments with the Grenz ray and the patient thought the condition was aggravated if anything.

| Case | Age | Sex | Areas of involvement | Clinical diagnosis | Mycologic findings KOH —cultures | Treatment with Grenz rays | Clinical results |
|------|-----|--------|--|--|--|---------------------------|--|
| 1 | 26 | Male | Intragluteal fold | Pruritus ani | KOH and cultures +++, yeast-like fungi | 0.25 unit | Cleared of symptoms in 72 hours |
| 2 | 31 | Male | Fingers left hand | Epidermomycosis | KOH and cultures +++, yeast | 0.25 unit 0.25 unit | Cleared but recurred in 3 weeks, after further treatment cleared entirely |
| 4 | 38 | Female | Intragluteal fold | Pruritus ani | KOH and cultures negative | 0.25 unit | No improvement, did not return |
| 5 | 31 | Male | Palm of right hand, right fingers | Epidermomycosis | KOH and cultures ++, yeast-like | 4—0.25 | All cleared |
| 6 | 30 | Male | Both axillæ marked, genitocrural, slight | Epidermomycosis | KOH ++, yeast-like | 3—0.25 | Five months previously received 4 X-ray treatments to axilla and 2 to the genitocrural region, but with no improvement. Markedly improved after this treatment |
| 7 | 26 | Male | Fingers and both hands to wrists | Dermatitis venenata with secondary superimposed mycotic dermatitis | KOH ++, yeast-like | 9—0.25 | All cleared |
| 8 | 50 | Male | Fingers and hands with toxic eruption from hands on neck | Dermatitis venenata with secondary superimposed mycotic dermatitis | KOH ++, yeast | 4—0.25 | All cleared |
| 13 | 20 | Female | Scalp, face, neck, axillæ, genitocrural, lower abdomen | Seborrheic dermatitis and mycotic dermatitis | KOH ++, yeast | 8—0.25 to all areas | Cleared after 3 treatments, but recurred. Additional Grenz therapy did not help much, other treatment given |
| 14 | 13 | Female | All fingers and both hands | Epidermomycosis | KOH ++, yeast | 4—0.25 | Marked improvement. Did not return |
| 15 | 25 | Female | Palms and index and middle fingers of the left hand | Dermatitis venenata with secondary superimposed mycotic dermatitis | KOH ++, yeast | 3—0.25 | All cleared |
| 17 | 42 | Female | Left thumb and index, right index and middle fingers | Epidermomycosis | KOH ++, yeast | 3—0.25 | Improved Did not return |
| 18 | 13 | Female | Scalp, face, neck, arms | Seborrheic dermatitis and epidermomycosis | Repeatedly negative for fungi | 7—0.25 | Very marked improvement. Much treatment preceding Grenz therapy |

(Continued on next page)

| Case | Age | Sex | Areas of involvement | Clinical diagnosis | Mycologic findings KOH —cultures | Treatment with Grenz rays | Clinical results |
|------|-----|------------------|---|--------------------------------------|---|---------------------------|--|
| 21 | 42 | Male | Feet and generalized eruption | Epidermomycosis and epidermomytid | First KOH and cultures contaminated. Later KOH and cultures +++ for yeast | 7—0.25 | All cleared |
| 22 | 11 | Female | Dorsum of toes and feet | Epidermomycosis | KOH and cultures +++ for yeast | 1—0.25 | Marked improvement |
| 23 | 42 | Female, pregnant | Toes, both feet, finger nails | Epidermomycosis | KOH and cultures +++ for yeast | 2—0.25 | Improved |
| 24 | 40 | Female | Third digital interspace of right hand | Erosio interdigitalis blastomycetica | KOH and cultures +++ yeast with fermentation | 4—0.25 | Markedly improved |
| 28 | 14 | Female | Toes of left foot | Epidermomycosis | KOH and cultures +++ for yeast | 5—0.25 | Entirely cleared |
| 29 | 40 | Female | Web between middle and ring fingers, right and left hands | Erosio interdigitalis blastomycetica | KOH and cultures +++ for yeast | 3—0.25 | Right hand treated with methyl-violet, left with Grenz rays. Right hand much better, both improved |
| 30 | 20 | Male | Toes and feet | Epidermomycosis | KOH +++ for yeast | 1—0.25 | Improved |
| 32 | 13 | Male | Toes and feet | Epidermomycosis | KOH negative cultures +++ for yeast | 2—0.25 | Improved |
| 34 | 24 | Male | Both feet | Epidermomycosis | KOH negative cultures — <i>Monilia</i> | 1—0.25 | Improved |
| 35 | 30 | Female | Fingers | Epidermomycosis | KOH and cultures +++ for <i>Monilia</i> | 2—0.25 | Marked improvement |
| 36 | 38 | Female | Toes, left foot | Epidermomycosis | KOH and cultures negative | 2—0.25 | Improved |

This substantiates our original observations—that good results were obtained in the patients who presented infections due to yeast-like fungi, while the infections of hyphomycetic origin showed very little, if any, improvement.

Experiences with occupational dermatoses complicated by secondary superficial fungus invasion are too meager to permit any fair evaluation at this time.

CONCLUSIONS

An experience of 22 more cases is added to a previous report of 30 patients who had dermatoses which were considered to be of superficial fungus infection and who were treated with Grenz rays used in fractional doses.

With such dosage, those infections due to yeast-like fungi responded quite uniformly to therapy, while those of hyphomycetic

origin showed very little, if any, improvement.

Further investigation is being actively pursued to determine the full worth of the above observations.

We wish to thank A. W. Stillians, M.D., and J. S. Coulter, M.D., for their many kindnesses in making it possible for us to study these cases and to have access to departmental facilities. We also wish to thank Miss Bertha Culka who has aided us greatly by performing all of the culture work.²

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²Expenses of the fungus cultures were defrayed by Therapeutic Grant No 143 of the American Medical Association

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Photographs Record Speedy Atomic Hearts
—World record speeds of hydrogen atomic hearts, pushed along by the pressure of 1,000,000 volts, have been photographed, investigators at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington have announced to the American Physical Society. Their speed was 13,400 miles per second. The high-speed protons, as the hydrogen atom hearts are called, were allowed to plunge into a moist atmosphere in a Wilson cloud chamber and snapshots were taken of the tracks made in the cloud by the rushing atomic projectiles.

The three physicists who did the work, Dr M. A. Tuve, Dr L. R. Hafstad, and Odd Dahl, won the thousand-dollar prize of the American Association for the Advancement of Science, 1930-1931 meeting, for previous high voltage work.

Million-volt protons had been produced and

measured by magnetic means in the same laboratory last year, but this is the first time their paths had been photographed. The speeds, of which the photographs are evidence, are the greatest yet obtained for artificially speeded protons. Protons of somewhat higher speed are produced when naturally produced alpha particles from radium are allowed to bombard paraffin. About one proton is given off for each million alpha particles. Artificial production by the Carnegie Institution method gives much larger quantities of the speedy protons than could be obtained even if large amounts of radium were used.

A high voltage tube of special design was used with a Tesla coil to produce the minute but relatively massive particles, but the three experimenters are now working with the electrostatic generator devised by Dr R. J. Van de Graaff as a better source of even higher voltage electrical current.—*Science Service*

GRENZ-RAY THERAPY¹

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Director

CREDIT is due to Bucky, who was the first to carry out systematically the idea of using roentgen rays of long wave length (Grenz rays or borderline rays) in the treatment of disease. Since he has published his good results in order to induce other clinicians to give this method a trial, many articles of a more or less critical nature have been written on the subject. An analysis of these publications must include only such papers as are based on accurate physical data, *i.e.*, definite indication of the quality and quantity of the radiation. It is also necessary to ascertain that roentgen rays of long wave length were actually used, in other words, rays produced at a potential not to exceed 10 KV, corresponding to a half value layer in aluminum of 0.03 millimeter. If this limit is exceeded it seems quite possible that the blood vessels of the skin may undergo injury similar to that following exposure to ordinary roentgen rays, particularly if high doses were used. In that case one deprives oneself, of course, of the great advantage of long wave length therapy, namely, the lessening of the danger of late injuries.

A number of late injuries observed can in all probability be explained by this fact or are due to an inaccurate determination of the quality. It is important in this connection to mention the result of an experiment which Fuhs conducted on his own skin. He exposed an area to 4,500 r which two and one-half years later showed very fine telangiectasis in a slightly atrophic skin. The latter had been exposed, however, to

sun rays rather frequently during the summer months.

We are using a half value layer of 0.02 mm Al which is produced on our apparatus with a potential of 10 KV and a tube current of 10 milliamperes. The longer wave lengths in the spectrum are made useful by not exceeding the focal skin distance of 10 cm for local treatment and 15 cm for general body exposures. Epilation was not observed in doses up to 5,000 r, given in one sitting.

The question of the exclusive character of the biologic action of Grenz rays when compared to that of ultra-violet rays and ordinary roentgen rays has never been explained satisfactorily. Holthusen denies a fundamental difference and classifies Grenz rays with the remaining roentgen spectrum. Politzer and Zakovsky did not see any difference between the effect of Grenz rays and that of ordinary roentgen rays on the mitosis of cells. At this point I would like to refer to two observations made by Hummel. He found that Grenz rays in doses up to 10,000 r did not decompose cholesterol or its fatty acid esters in certain solutions, while ordinary roentgen rays do. Nor was an effect seen if cholesterol dissolved in blood serum was exposed to Grenz rays *in vitro*. In my own erythema tests on human skin I noticed that the first visible erythema appeared following doses of from 240 to 480 r, and that up to doses of 2,400 r and more the reaction takes its usual course. If, however, a dose of 4,800 r was applied, a very marked erythema appeared immediately which developed within three days to a pillow-like swelling, led to an intense blue-red discoloration, remained unchanged for al-

¹Read for the author by J. N. Sisk, M.D., as part of the Symposium on Grenz-ray Therapy before the Radiological Society of North America at the Seventeenth Annual Meeting at St Louis, Nov 30-Dec 4 1931.

origin showed very little, if any, improvement

Further investigation is being actively pursued to determine the full worth of the above observations

We wish to thank A. W. Stillians, M.D., and J. S. Coulter, M.D., for their many kindnesses in making it possible for us to study these cases and to have access to departmental facilities. We also wish to thank Miss Bertha Culka, who has aided us greatly by performing all of the culture work.²

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Photographs Record Speedy Atomic Hearts—World record speeds of hydrogen atomic hearts, pushed along by the pressure of 1,000,000 volts, have been photographed, investigators at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington have announced to the American Physical Society. Their speed was 13,400 miles per second. The high-speed protons, as the hydrogen atom hearts are called, were allowed to plunge into a moist atmosphere in a Wilson cloud chamber and snapshots were taken of the tracks made in the cloud by the rushing atomic projectiles.

The three physicists who did the work, Dr. M. A. Tuve, Dr. L. R. Hafstad, and Odd Dahl, won the thousand-dollar prize of the American Association for the Advancement of Science, 1930-1931 meeting, for previous high voltage work.

Million-volt protons had been produced and

measured by magnetic means in the same laboratory last year, but this is the first time their paths had been photographed. The speeds, of which the photographs are evidence, are the greatest yet obtained for artificially speeded protons. Protons of somewhat higher speed are produced when naturally produced alpha particles from radium are allowed to bombard paraffin. About one proton is given off for each million alpha particles. Artificial production by the Carnegie Institution method gives much larger quantities of the speedy protons than could be obtained even if large amounts of radium were used.

A high voltage tube of special design was used with a Tesla coil to produce the minute but relatively massive particles, but the three experimenters are now working with the electrostatic generator devised by Dr. R. J. Van de Graaff as a better source of even higher voltage electrical current.—*Science Service*

eral years in order to ascertain if these cases are permanently cured and if late injuries will appear. In a critique of Grenz-ray therapy one must not forget that, in ordinary roentgen therapy, it is necessary to approach the toleration of the tissue in order to obtain a therapeutic effect. On the other hand, we should remember that other treatment methods are available in *lupus vulgaris*, as, for instance, the Finsen light ointments, and the ultra-violet lamp, from which permanent results can be obtained without injury to the skin.

In the treatment of carcinomatous skin lesions, Grenz-ray therapy is, in our opinion, contra-indicated. X-ray deep therapy and radium treatment lead here to excellent results in so high a percentage of cases that it does not seem justifiable to change from a long proven method to a new and apparently less effective one. Considering the rapid loss of radiant energy when Grenz rays are used, due to the high absorption, even very intense doses will not permit of homogeneous irradiation, which is essential in the successful treatment of skin carcinoma.

Excellent experimental investigations have been carried out by Krasso, Mylius, and Erggelet concerning the effect of Grenz rays on the cornea and lens. When applying the doses used in therapy no injury of the cornea or the lens could be seen even after prolonged periods of observation. When compared with roentgen or ultra-violet rays, the advantages of Grenz rays in the treatment of inflammations of the cornea are obvious. There is no danger of injury to the deeper layers of tissue in the eye and the therapeutic procedure is not only not painful but sometimes is even analgesic.

Bucky also reported good results in local skin diseases treated by general body exposure to Grenz rays. However, none of the clinicians who repeated this work has been able to confirm his claims, although one might expect results in treatment of the

universal eczema with exudative diathesis which is seen in children. A regression in hypertrichiasis following general body exposure could not be brought about in our cases, this is also at variance with Bucky's statements. We have not been able so far to verify the appearance of pigmentation in cases of vitiligo of several years' duration as reported by Bucky and Buschke.

Bucky explains the results by postulating an effect of the Grenz-ray irradiation on the vegetative nervous system and also indirectly on the glands of internal secretion. Great interest was created by the communication of Bucky that polycythemia rubra was improved following general body exposure to Grenz rays, this has been confirmed recently by Schilling. It is remarkable that, while we may be certain these rays cannot reach the bone marrow, a pathologic process originating in the bone marrow and, therefore, usually treated by X-ray deep therapy, is influenced by Grenz rays. It is only possible that an indirect effect can take place *via* the change in the skin. Schilling investigated the findings of Bucky very thoroughly. He could not confirm the constancy of the leukocyte drop following Grenz-ray exposure, but, on the contrary, sometimes saw an increase of the leukocytes. Following irradiation, a definite bradycardia appeared, lasting from 20 to 25 minutes, which was interpreted as being due to a stimulation of the vagus. In patients with hypertonia of various origins there was always a definite drop in the blood pressure 30 minutes after the treatment which, however, lasted only from one to one and one-half hours. In the normal individual the blood sugar dropped, the same reaction was noted in diabetics, while patients with toxic goiter showed an increase. The basal metabolism was not influenced at all. According to the experience of this author, Grenz-ray therapy was of benefit in asthenic patients, in asthma in polycytemia, and sometimes in toxic goiter.

most three weeks, and developed then into pigmentation without producing blisters or ulceration. A skin area of the same size exposed to roentgen rays of short wave length (1,000 r) showed definite blistering after four weeks. This peculiar course of the erythema reaction corresponds neither to the skin reactions seen following ultraviolet exposure nor to those seen after exposure to roentgen rays of short wave length. The former usually disappear much more quickly, while the latter reach their maximum much later or, if they appear immediately, soon lead to blistering or ulceration. A therapeutic effect of Grenz rays on rickets was not observed (Rominger).

From a theoretic standpoint, there are two points of advantage in the treatment of skin diseases by roentgen rays of long wave length. One is the almost complete absorption in the upper layers of the skin which has been proved by absorption measurements, the other is the protection of the deeper layers of the tissue. In addition, there is also the wide margin of safety between the therapeutically effective dose and the injuring dose, which decreases with increasing wave length. In a series of cases of eczema and neurodermatosis in which the lesions were symmetric, we carried out the treatment by exposing one side to Grenz rays and the other side to ordinary roentgen rays. While in the overwhelming majority we saw, in accordance with the observations of Fuhs and Konrad, Spiethoff, and others, an even regression, sometimes there was a preponderance of the effect of Grenz rays. Our single doses very seldom exceeded 240 r and we usually did not have to apply more than 480 or 720 r as a total dose (measured in air). The same can be said in regard to skin diseases during childhood. Rominger states that the universal dry types of eczema, accompanied by considerable pruritus, are the field for Grenz-ray treatment. In all exudative and crustal types of eczema of the

head and face, improvement was seen following Grenz-ray therapy. Psoriasis responds in the same manner as it does following ordinary roentgen therapy, in view of the great absorption of Grenz rays it is absolutely necessary to remove the scales before the exposure. The advantage of Grenz rays in this disease lies in the fact that relatively large areas of the skin can be irradiated without danger, while, if ordinary roentgen rays are used, the possibility of a blood injury increases with the number of exposed fields.

Even if we assume equal therapeutic effects of Grenz rays and ordinary roentgen rays, preference should be given to the former because of the protection of the deeper non-diseased tissue. It is for this reason that Grenz-ray therapy is so suitable for the treatment of skin lesions of the scalp, of the lids of the scrotum, and of the cheeks.

Another type of skin lesion yielding well to Grenz-ray therapy is the dilatation of superficial blood vessels. A nevus flammeus disappeared after 500 r, given during two exposures. Caution is indicated in irradiating acne rosacea in the face. After a very conservative dose of 240 r, a reddening and swelling of the face appeared immediately following irradiation and lasted about eight days, being accompanied by intense itching and burning. As in any other type of radiation therapy, it is imperative to feel one's way in order to arrive at the proper dose and it is always advisable to start with a very small amount of radiant energy.

In tuberculous skin diseases, a heavier dosage is necessary. Most suitable for Grenz-ray therapy is the ulcerating type of erythema induratum Bazin. The publications of Spiethoff show, to judge from illustrations accompanying them, excellent results in lupus vulgaris. The doses used are sometimes extremely high, reaching 25,000 r. It seems advisable however to wait sev-

ranged to build up an apparatus in which to generate the energy to operate them. We have treated a number of superficial skin lesions of the fungus or yeast-like type, but we did not make a microscopic diagnosis in all of these cases. While we have received very satisfactory temporary results from the Grenz ray in some of these lesions, in others we did not see very much improvement. We have made no cures whatever.

At this time, I cannot say if all of our cases were of the hyphae mycetic type. In fact, I do not recall that at that time we made any diagnoses, microscopically, of the yeast-like type, although we studied several, but we did not find the organism. We tried the Grenz ray in psoriasis, but could not see that there was any more benefit from this wave length than from the shorter therapeutic X-rays. In fact, I might say the same thing in regard to hyphae mycetic infections. We finally had to go back to the use of various chemicals.

It is possible that the matter brought out by Dr Dorne can be explained on the basis of the selective action of this special band of rays. That the rays in the roentgen- and gamma-ray fields have no selective action, all acting alike, is, I think, generally conceded by most men working in those fields to-day. Dr Brackett, of the Smithsonian Institution, is not quite convinced that this is so, being rather inclined to think that there is a selective action. However, when we get into the ultra-violet and the visible fields, we are in fields in which there is a very decidedly selective action. In the infra-red field, we see a very selective action. It is possible that in the borderline field we may have a selective action that explains some of the results which are reported from the use of Grenz rays, both locally and constitutionally.

Dr Reisner refers to the treatment of polycthemia and some other constitutional troubles. While I have been inclined to ridicule any beneficial action from these rays in such diseases, I realize that we have to be careful in making judgments.

In treating the whole body, would not the Grenz ray, at a distance of 50 centimeters, be almost entirely absorbed by the air?

Perhaps we cannot figure on any direct depth action of the rays in the skin to account for constitutional results. We must remember that very definite constitutional results, in rickets, etc., are obtained from ultra-violet rays which do not penetrate deeply into the skin. It is just possible that there is a similar action from the Grenz rays.

Dr Reisner stated that, in treating psoriasis, it was necessary to scrape the scales off in order to get results, because of the filtration of the scales. He mentioned 10 KV, but throughout the paper he has not specified whether they were using 10 KV or less. With 8 KV, I got enough penetration through my thumb nail to damage the matrix severely, with 10 KV, I think the damage would have been much more serious. Certainly, using X-rays of 8 KV, the nail did not give much protection to the matrix.

In the case of nevus flammeus, I was much surprised at the author's results with a single dose of about 240 r, however, he has not stated the size of the birth mark or the age of the child. Those factors are very important in the treatment of nevus flammeus by other methods.

When he treats lupus vulgaris with 2,500 r, he is giving a hundred times the erythema dose. I would hesitate to use that much in lupus vulgaris for fear of stimulating malignant epithelial growth.

DR ARTHUR MUTSCHELLER (New York City). In this symposium, so much valuable material has been presented that it would be impossible to discuss each and all of the phases that have been brought out. I think, however, one point was noticeable throughout all these papers, which I believe should be clearly kept in mind for the future.

Dr Glasser brought out the point that there is considerable difference in the various kinds of windows. Theoretically, of course, the composition of the Lindemann glass would be such that it would transmit the long wave length rays better than any other kind of glass. However, the Lindemann windows are not blown, and the thickness of these windows cannot be regulated. Rather, they

It is not indicated, however, in spastic conditions of the gastro-intestinal tract or in any type of anemia. Bucky also reported good results in Grenz-ray therapy of duodenal ulcer and in gastritis, which were confirmed by Levy, Kestle, and Gertz. Most striking in these cases was the relief from pain. Bucky based this treatment of gastro-intestinal conditions on the observation that, following burns of the skin, hemorrhages in the gastro-intestinal canal are sometimes observed. It seems evident that, up to now, our knowledge of the efficacy of Grenz-ray therapy in the treatment of internal diseases is limited; it must be tried out on a large number of cases before we arrive at a conclusion.

SUMMARY

From a study of the world literature and from our own experience with X-rays of long wave length, we may sum up the present situation in this field as follows:

1 The basis for successful Grenz-ray therapy is exact dosage.

2 For the treatment of superficial skin diseases, Grenz-ray therapy offers a valuable addition to our therapeutic armamentarium.

3 While the therapeutic effect is approximately the same as that of ordinary roentgen rays, sometimes it seems slightly superior.

4 The advantage lies in the fact that the deeper layers of tissue are well protected and that the therapeutic dose can apparently be administered without danger of immediate or delayed injuries.

5 In the treatment of local disease, the value of general body exposures to Grenz rays is a very much debated problem.

6 A final judgment as to the effect of Grenz rays on internal diseases cannot be passed at the present, but further investigations in a large number of cases are necessary and seem to be worth the effort.

7 Injuries following Grenz-ray therapy

can apparently be avoided if very soft rays are used and if the smallest dose required for the therapeutic result is administered.

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DISCUSSION

DR. ROLLIN H STEVENS (Detroit, Mich.)
It is some four or five years since we received our first Lindemann tubes, and Dr. Pohle ar-

ods we have used, with the idea of not condemning unnecessarily Grenz rays or Bucky's work, until they have been given a very thorough trial

It is true that not enough cases have been treated, nor has the time been long enough really to determine the end-result

At the April meeting of the New York Dermatological Society, Dr George M MacKee presented a case of telangiectasia caused by Grenz rays, treated about three years before presentation to the Society. This has been reported in the November, 1931, issue of the *Archives of Dermatology and Syphilology*, page 926. At this same time Dr Eller stated that he had had six similar cases which developed after three years. I believe that heavy dosage is probably the cause of these reactions. It is my impression that we are the first to concentrate on the fractional doses and I feel that it is important for us to give this a fair trial.

As to the difference of intensity varying with the distance, we noted that immediately upon starting our work It was about ten months or a year before we actually treated anybody. We were not familiar with the apparatus, so we worked out a number of problems in an effort to determine various factors

All our treatments are given alike for distance, in order to avoid the loss of intensity occasioned even by a difference of a fraction of an inch. We constructed a small gauge, by screwing a little plug of wood into the center of a piece of aluminum, which fit snugly against the water jacket surrounding the tube. The tip of the wood measured exactly three inches from the center of the tube. All our skin-tube distances are measured by this means.

As to the treatment of psoriasis and the removal of scales, I think the *modus operandi* is similar to the following when Bucky and Eller first reported their cases, they included a large series of epitheliomas of the eyelids in which they got their best results. In the discussion of that paper, Dr Pusey stated that it was his impression that the rays reduced the epithelioma, layer by layer. Shortly after this, in 1929, Herxheimer and Uhlmann working

in Germany, performed histologic examinations in a series of cases in which the patients were treated with these rays, demonstrating that the effect was limited to the epidermis and did not involve the cutis. The changes they reported occurred following small doses of the rays which, nevertheless, completely sufficed to produce therapeutic results. In the end the small doses reach the deeper layers of the skin by routine radiation. They decided that in this manner they could determine the practical boundaries of the application of this kind of ray. It is my feeling that this may, in a way, explain the question as related to psoriasis. With probably one or two exceptions, we have not attempted to treat psoriasis, and these only as a matter of setting off our routine with the fungus infections.

As to nevus flammeus, in their newly printed book on Grenz rays, Conrad and Fuhs recommend 1,000 r units at five-week intervals. Others advise even three or four times that dosage at longer intervals. These, in my estimation, are rather large doses and just the thing we are trying to avoid until we know more about the sequelæ from Grenz rays. We have just started to treat cases of this type.

Of course, there is much work to be done. Earlier I made the statement that practically every dermatologic entity—there are few exceptions—has been treated by this method by the different workers, with varying results. The impression one gains is that, in many instances, enthusiasm and over-confidence have biased the results, while in other instances prudence and ultra-conservatism have prejudiced the results.

I think that if we follow a conservative course and give the Grenz rays a good trial, they may prove to be of value.

We are continuing our work and are starting on a parallel series of treatments. The cases will all be of the superficial fungus infections. Diagnosis will be made in the same way and similar cases will be treated in parallel groupings. X-ray, Grenz ray, and ultraviolet ray. We hope to be able to add something more to the work already done.

DR ERNST A POHLE (Madison, Wisconsin) I wish only to emphasize one point

are pressed in a mould, and, usually, in order to counteract the effect of possible deterioration by moisture, these windows have been made thicker and thicker. As a result, as a medium for the transmission of X-rays or Grenz rays Lindemann glass has become less and less effective.

Some of the results described, and the doses that are used for certain effects, clearly point out that fact. Dr Glasser found it better to use lithium glass. At the same time that Dr Slack developed the drawn-in window, he also had, independently, the same idea and found better results could be obtained with a drawn-in thin glass window. In other words, the thinness of the window seems to be a distinct advantage over the apparently more favorable atomic composition of the Lindemann window, the constancy of the tubes with drawn-in windows is so far superior that they ought to be the type to be used exclusively in the future.

Comparison of some doses or rather some intensities that are emitted from thin window tubes and some of the tubes with Lindemann windows, shows a very striking difference. Ordinarily, with a given tube current and voltage, the radiation emitted from some of the Lindemann window tubes imported from Germany is approximately one-third of that obtained with tubes of the drawn-in window. Thus we have been measuring with 8 KV and 8 ma, at a distance of 10 cm, an average intensity of 350 r per minute. This is just about three times, or even more, the intensity that is ordinarily measured with any of the Lindemann window tubes.

One further point of great importance, I believe, has not been brought out in either of the two text-books now available on the subject. I am referring to that of Fuhs and Conrad and of Bucky. These writers refer to the inverse square law, and in a casual way indicate that probably the inverse square law is not obeyed by Grenz rays, failing, however, to give any specific data. Measurements we have made point out that there is a very considerable difference or divergence between the inverse square law and the actual measurements, and that these differences should be clearly kept in mind.

Just to give one example, let us assume that we designate the radiation intensity at 10 cm distance, 8 KV, and 8 ma as unity. Taking 15 cm, we should theoretically have 44 per cent of that. In reality, we measure only 25 per cent. Or, going to the other extreme, at 7 cm distance, a lesser distance, instead of measuring about twice the intensity, we are measuring 26 times the intensity.

It practically means that, if we use the inverse square law and work at a shorter distance, we shall over-dose, and if we are working at a longer distance, we shall under-dose. The difference, of course, is due to the absorption of the rays in the air layers. I believe, therefore, it falls upon the manufacturer of tubes to supply a correct table of radiation intensities for various distances.

There are a great many more points that could be discussed. There is in particular one while the name "Grenz ray" is probably highly appropriate we should not forget that these rays are still roentgen rays, and, though they appear to have a specific action of their own that specificity is due entirely to their definite physical properties.

Furthermore, it does appear as very important that alongside of the correct quantity dosage the correct control of the voltage would be a very important question. For instance, the reports of the Frankfurt (Germany) laboratory, I believe, are always on 10 KV, and it seems that even with very small doses they produce a distinct effect upon the vascular system. But if the voltage is only 2 KV lower it seems that very much larger doses can be given without producing the same pronounced effects on the blood vessels.

I am merely mentioning this to point out that the control of voltage is a very important factor and if the tube voltages are properly adjusted the safety of the use of the Grenz rays is considerably increased.

DR MAURICE DORNE (closing). In our investigations the results obtained are not by any means conclusive. Rather, they are suggestive and we have written these papers with the idea that probably we could stimulate more work among the radiologists, the physicists and the dermatologists, according to the meth-

ROENTGEN THERAPY IN BONE METASTASIS OF CARCINOMA¹

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BONE metastasis from carcinoma and its treatment have been discussed repeatedly in a general way (1, 2) and numerous case reports can be found in the literature (2, 3, 4, 5). Such publications have made it clear that bone metastasis may respond in a remarkable way to roentgen therapy and that the patient may be relieved from severe pain for relatively long periods. A more definite impression of what may be accomplished should be obtained from a report of all carcinoma patients treated for bone metastasis. In an attempt to do that we have gone over our treatment records of carcinoma of the breast, prostate, cervix and corpus uteri, and thyroid. Hypernephroma and melanoma have also been included in this survey. The records have been collected since July, 1926, when high voltage therapy was introduced at the University Hospital.

It should be kept in mind that patients seldom come to a cancer institute until the disease is far advanced. A routine procedure to discover bone metastasis has not been carried out, as a rule, as it may occur in almost any bones of the body and a complete roentgenologic study would be impracticable. The pelvis is, however, almost always examined roentgenographically in carcinoma of the prostate. Pain is the most common symptom which leads to the diagnosis of bone metastasis. In three instances the diagnosis was made in spite of the fact that the X-ray films were negative and in four others the diagnosis was made without any X-ray film. On the other hand, in some instances, metastatic bone lesions causing neither pain nor other clinical symptoms

have been discovered on X-ray films. It is, therefore, evident that many patients may have had bone metastases which were never discovered.

In Table I the total number of patients who have been treated with high voltage roentgen rays is given and also the number of those with known bone metastasis. The occurrence of bone metastasis has not been expressed in percentages as the number of patients is too small to give reliable figures in this respect. The patients who are known to be dead are grouped separately, the others are referred to as alive, though some of them probably are dead by this time.

It is well known that bone metastasis in carcinoma of the prostate is very common. Table I shows that more than one-half of our patients (22 out of 38) had bone involvement. Carcinoma of the breast comes next with almost one-third of the patients (49 out of 156) in the metastatic group. Bone metastasis in carcinoma of the body and cervix of the uterus has been recorded in only 3 out of 165 patients. The occurrence seems to be more frequent in carcinoma of the thyroid (1 out of 4), in hypernephroma (5 out of 16), and in melanoma (1 out of 12). This is in agreement with the statements of other authors.

Carcinoma of the breast gave rise to both osteoclastic and osteoblastic types of metastasis in 11 cases, to osteoblastic only in 3 cases, and to osteoclastic in 30. In five cases the type was not determined. Which bones become involved seems to be mainly a matter of chance and may be seen in Table II. In comparing this table with that of W S Handley (7) on the frequency of carcinomatous bone metastasis, we find there is some difference. This undoubtedly

¹Presented before the Semi annual Meeting of the Minnesota Radiological Society Minneapolis Minnesota, October 25 1930

which has seemed to be prominent throughout the entire discussion, namely, the importance of actually measuring the dose under the same conditions as you use for treatment. Although Dr Mutscheller's suggestion is a good one, I would much rather see the radiologist place

his ionization chamber at that distance from the focus of the tube, when he wishes to determine the surface dose, not only every 100 hours, but every 25 hours of tube life, in view of the changes apparently occurring in this type of tube

STUDY SUGGESTS NEW LINE OF CANCER RESEARCH

A suggestion for new methods of research into the cause of cancer and of certain obscure blood diseases is one of several important lessons to be learned from a study of radium dial painters' cancer, it appears from a lengthy report on this occupational disease made by Harrison S Martland, M D, medical examiner of Essex County City Hospital, Newark, N J, to the *American Journal of Cancer*.

Dr Martland reviewed the cases of the radium dial painters, and showed that cancer does occur in radio-active persons. The cancer in these cases developed from the constant bombardment of each victim's body by the alpha particles emanating from the radium stored in her bones, he explained. This suggests new methods for producing experimental cancer. But, more important, it suggests that, since very small amounts of radium taken into the bodies of watch dial painters quickly produced cancers, the occurrence of other forms of cancer in man may be the result of much smaller amounts of radio-active substances present in the body over much

longer periods of time. These amounts would be too small to measure or even to detect by present methods.

Dr Martland considers less than one-half of a microgram of radio-active substance dangerous. He emphasized in the report what an infinitesimal amount of radio-active substance is necessary to destroy life.

"A milligram of radium bromide is not much larger than a small grain of sand," he explained in this connection. "One microgram is only one-thousandth as large, is invisible, and cannot be detected by any known chemical method. It is necessary to have only ten micrograms, or one hundred thousandth of a gram, distributed over the entire skeleton to produce a horrible death years after it has been ingested."

"This is interesting when it is recalled that the fatal dose to man of the toxin produced by *Bacillus tetani* (the germ of tetanus or lockjaw), one of the most powerful soluble poisons known, is twenty-two hundredths of a milligram or about one three-hundredth of a grain," he added.—*Science Service*

outcome was unknown in six. Of the other patients, representing mainly the osteoclastic group, partial or complete relief of pain was obtained in 28, no relief in one, the results were not known for 22, seven patients were not treated for the bone metastasis, and one never had any pain. The relief from pain usually came within a week after the treatment, lasting from a couple of weeks to more than one year following one series of treatments. When the records were made, an analysis of results in bone metastasis was not considered and the notes are, therefore, incomplete in this respect. It may be mentioned, for example, that a patient improved after treatments without definite reference to the bone metastasis. That is the reason the results are put down as "not known" for some of the patients.

The relief of pain is undoubtedly due to improvement of the lesion itself as has been recently pointed out by Borak (11) of Vienna. Borak emphasized the relative sensitivity of bone metastasis as compared to the primary lesion and to other metastasis, considering this due to the fact that no epithelium is present in the bone and therefore the growth changes somewhat its character. He ascribes the pain to pressure on the periosteum or nerves surrounding the bone. If epithelial tissues become involved in this region, then the resistance to radiation ought to increase and this would explain why it sometimes is very difficult to influence the growth. Borak seems to believe that often the metastatic lesion of bone is healed completely. Unfortunately X-ray films were made only exceptionally after treatment in our group of patients. The impression obtained from these was, however, that complete healing is a rather rare occurrence. In 12 cases of mainly the osteoclastic and in four cases of mainly the osteoblastic type, X-ray films were made both before and a reasonable time after treatments. Nine of the former and one of

the latter showed a definite improvement. In at least one case the lesion seemed completely healed and the bone practically normal at the last X-ray examination. The patient grew worse, however, due to progression of other metastases.

When all the patients with bone metastasis are considered together, it seems that the benefit from the treatments is of rather short duration. This is in many cases due to the fact that the original lesion, as well as metastasis to glands and other organs, continued and soon brought the patient to a helpless condition, or death. In spite of this it seems that the treatments, as a rule, have been worth while. They have made it possible to reduce the use of drugs (such as morphine) and in many cases have enabled a bedridden patient to become ambulant, e.g., Case No. 396. The benefit obtainable has been emphasized by some exceptionally good results.

CARCINOMA OF THE BREAST

A T., No. 396, age 46 years. In 1923 the patient noticed a lump in the left breast. Radical amputation of the breast was performed at that time at the Mayo Clinic, following which the woman received post-operative X-ray treatment to the breast in two series there and at Aberdeen, South Dakota. One year later, at the Mayo Clinic, radium was inserted in the glands of the neck and locally to the breast. She reported to the University Hospital in December, 1927, with metastasis to the pelvis and spine. She had been unable to walk and had been confined to her bed for one month because of pain in the pelvis and hip. At this time she received a series of four treatments over the pelvis, anterior and posterior, amounting to a 120 per cent erythema dose to the tumor. She returned in March for check-up and more treatment, at which time she was able to walk and was free from pain in the pelvis. She had also gained 25

can be explained by the fact that his statistics were based on postmortem findings, while in this survey the metastases were substantiated by X-ray examination. Unless each bone is sectioned in an autopsy one is very apt to overlook bone metastasis, hence, many metastatic lesions may have escaped discovery. Though it seems fairly well established that carcinoma may spread to the bones through both superficial and deep lymphatic channels (4, 8), it is probable that the cells are quite often transplanted by blood (8, 9, 10). An example is seen in the patient (No. 702, Table III-A), with primary lesion in the right breast and with demonstrable metastasis limited to the left calcaneum, carpus, and ulna. Biopsy, taken of the calcaneum, showed metastatic adenocarcinoma.

Carcinoma of the prostate gave rise to both osteoblastic and osteoclastic metastasis in five patients, to osteoclastic in only one, and to osteoblastic in 16 patients. The bones involved may be seen in Table II.

Three cases of carcinoma of the cervix and body of the uterus gave rise to osteoclastic metastasis, represented in the pelvis, femur, dorsal, and lumbar spine. One case of carcinoma of the thyroid showed osteoclastic metastasis in the dorsal spine, right and left femur, and right ribs. Four hypernephroma patients had osteoclastic metastasis with irregular distribution. One patient with melanoma developed osteoclastic metastasis to a rib.

It is interesting to observe that bone metastasis sometimes occurs quite early, in some of the patients pain in one or more bones was the first symptom of metastasis anywhere in the body (10). In 14 of the patients no other metastasis was found. The time that elapsed between the operation on the primary lesion and the first treatment for bone metastasis is given in the tabulations. The shortest interval from a radical mastectomy to treatment of bone metastasis was one month and the longest interval ten

years. We may conclude from this that it is apt to become noticeable almost any time, and a careful check-up of the patients is needed. The sooner the bone metastasis receives roentgen-ray treatment, the better results and the more prolonged palliation we may expect.

TREATMENTS

The treatments were carried out with high voltage, the usual factors being 200 KV, 30 ma, 1 mm copper plus 4 mm aluminum filter, and 60 to 70 cm target-skin distance. As a rule the treatments consisted of a full erythema dose (our erythema producing definite reddening and pigmentation) to the skin immediately above the involved bone. Sometimes the treatment was given at one sitting, but more often it was divided into two seances, given on the first and third day, with 10 per cent added to make up the loss in time. Sometimes the bones were irradiated from two sides and then usually in four fractional treatments. The dose given to the lesion in the bone never was less than 80 per cent or more than 120 per cent of our erythema dose. The treatments were in many instances repeated after about two months. The greatest number of series of treatments given to any one area was four.

The aim of the treatments was mainly to relieve pain and the results in this respect are shown in Column 4 of Tables III-B and IV-B, and Column 3 of Tables V-B and VI-B. The length of time the patients have been followed after treatments of bone metastasis can be found in the last column. As was to be expected, the osteoclastic type of metastasis responded to treatments much better, as a rule, than the osteoblastic type. Partial or complete relief of pain was however, obtained in 10 cases of carcinoma of the prostate which is to be considered mainly as representing the osteoblastic type. Six of these patients had no relief and the

of pain in the back, right hip, and shoulder for which he received treatment. He was given a series of treatments over the hips, pelvis, and spine at the time but his condition was not very good—he had hematuria. He has not been heard from since May, 1929 (22 months), but is undoubtedly dead.

SUMMARY

1 The records of patients treated with high voltage roentgen therapy since July, 1926, have been investigated in regard to metastatic carcinoma to the bones. A statistical survey has been made of carcinoma of the prostate, breast, thyroid, cervix and corpus uteri, and of hypernephroma and melanoma.

2 Metastases to the bones were found to be common in carcinoma of the prostate and breast. They may occur at any time and in any location and one should watch out for symptoms, especially pain, which indicate such lesions.

3 Carcinoma of the uterus and cervix does not as a rule give rise to bony metastasis but occasionally it may. Other investigators have found the incidence of bone metastasis relatively high in cases of carcinoma of the thyroid, hypernephroma, and melanoma. Our records show an agreement in this respect, though the number of patients reported is small.

4 The tables show which bones were found to be involved, the means of diagnosis used, whether metastasis was of the osteoblastic or osteoclastic type, the time interval between radical operation of the primary lesion and first treatment of bone metastasis—also between this treatment and the last time the patient was seen, number of complete treatments, and improvement of pain and of the lesion as shown by X-ray films.

5 Most of the patients, particularly those exhibiting the osteoclastic type of metastasis, benefited by the treatment. Though the improvement was of rather short duration for the group as a whole, it was quite remarkable in some few instances. It seems that the roentgen treatments have been of very definite value in reducing the amount of drugs needed for pain, in getting patients out of bed, and in restoring some of them to useful lives for as long as two years.

TABLE I

| | ALIVE | | DEAD | | TOTAL | |
|---------------|-------|-----------------|-------|-----------------|-------|-----------------|
| | Total | Bone metastases | Total | Bone metastases | Total | Bone metastases |
| Prostate | 28 | 13 | 10 | 9 | 38 | 22 |
| Breast | 104 | 26 | 52 | 23 | 156 | 49 |
| Cervix | 92 | 0 | 38 | 2 | 130 | 2 |
| Corpus | 24 | 0 | 11 | 1 | 35 | 1 |
| Thyroid | 3 | 1 | 1 | 0 | 4 | 1 |
| Hypernephroma | 12 | 2 | 4 | 3 | 16 | 5 |
| Melanoma | 10 | 1 | 2 | 0 | 12 | 1 |
| Total | 273 | 43 | 118 | 38 | 391 | 81 |

TABLE II—FREQUENCY OF INVOLVEMENT IN THE DIFFERENT BONE REGIONS

| Bones involved | Breast frequency | Prostate frequency |
|---|------------------|--------------------|
| Spine | 34 | 12 |
| Pelvis | 30 | 21 |
| Shoulder region | 4 | 1 |
| Ribs and sternum | 13 | 5 |
| Humerus | 7 | |
| Both femurs | 3 | 4 |
| Either femur | 14 | 2 |
| Skull | 6 | |
| Knee region | 1 | |
| Calcaneum | 1 | |
| Carpus | 1 | |
| Ulna | 1 | |
| Total number of times bone regions involved | 115 | 45 |

pounds in weight in four months. Between the time of admission in December, 1927, and the time of death in March, 1930 (27 months), the patient received six series of deep X-ray treatments to the pelvis, entire spine, and right shoulder girdle and was kept very comfortable as far as pain was concerned. Her physical condition kept up very well. On November 9, 1929, she fell, sustaining a pathologic fracture of the femur, and was confined to her bed. She died March 31, 1930. Information received from a sister seemed to indicate that the patient had had chest involvement and intercurrent pneumonia.

A H, No. 69.—The patient had had a radical breast amputation in January, 1924, remaining fairly well until the Fall of 1925, when she began having pain in the right hip and back. In May, 1926, she had received a series of deep X-ray treatments at St. Barnabas Hospital, St. Louis, Mo., with resulting relief of pain. In June, 1926, she began to have severe pain in the head and neck and X-ray films showed metastasis to the thoracic and cervical vertebrae. She was not able to move about at all except in a wheel chair. X-ray films made at the University Hospital in September, 1926, revealed multiple metastases to the pelvis, femora, lumbar, dorsal, and cervical spine, with several vertebrae almost entirely destroyed. The patient received a series of deep X-ray treatments at this time, as well as in November, 1926, with marked relief, and was able to walk about as usual and to do all her own work. After this series of X-ray treatments she entered a Christian Science Home and so gave all credit to "divine healing." She remained well until January, 1928, when she was forced to remain in bed again. She died in April, 1928 (16 months), but was faithful to Christian Science to the end.

CARCINOMA OF THE THYROID

C D, No. 48958, age 72 years. The

patient, who had had thyroid enlargement for 10 years, noticed that the gland had increased markedly in size in the 6 months preceding examination. She complained of weakness, dyspnea, and a feeling of pressure. Thyroidectomy in July, 1929, revealed a malignant melanoma. She received a series of prophylactic X-ray treatments to the neck region in July, following operation, and in January, 1930. In March, 1930, the patient developed pain in the dorsal spine. X-ray examination revealed multiple osteoclastic metastases of this region. A series of deep X-ray treatments over this region afforded relief. In June pain developed in the left hip, but was relieved by treatment. In August, she complained of pain in the right ribs and dorsal spine, receiving another course of treatment with relief. Because of pain in the pelvis, the woman is at present receiving a course of treatments in that region and has already been relieved completely. It is interesting in this case to note that the patient experienced relief within two days of the first treatment. Her physical condition is very good and there is no sign of any local or glandular recurrence (7 months).

CARCINOMA OF THE PROSTATE

C T, No. 41166, age 66 years. Onset occurred in the latter part of May, 1927, with dysuria and dribbling. The patient became progressively worse until August, 1927, when he came to the University Hospital where his case was diagnosed as carcinoma of the prostate. He received radium implants into the prostatic gland. At this time, he complained of pain in the right femur and radiograms revealed osteoblastic metastasis to the right femur. He then received a course of deep X-ray treatments to the pelvis and the right femur, with relief of pain although the X-ray plate showed progression of the bone lesion following treatment. In November, 1929, he complained

TABLE III-B—CARCINOMA OF THE BREAST, LIVING—26 OF 104 CASES

| X-ray No | Time from operation to treatment | No of treatments | Pain | X-ray | Time followed |
|----------|----------------------------------|------------------|---|------------------------------|---------------|
| 251 | 6 years | 3 | Complete temporary relief | Improvement | 18 months |
| 317 | 2 years | 3 | Not known | None made | 2 months |
| 579 | 12 months | 4 | Not known | None made | |
| 653 | 6 months | 4 | Complete temporary relief | None made | 5 months |
| 665 | 13 months | 3 | Treatment discontinued, poor condition | None made | 1½ months |
| 679 | 24 months | 4 | Complete permanent relief after each treatment | Improvement | 14 months |
| 680 | 14 months | 2 | Complete permanent relief | None made | 20 months |
| 702 | 9 months | 5 | Complete permanent relief | Fracture of calcaneum healed | 8 months |
| 713 | 17 months | 3 | Not known | None made | 1 month |
| 724 | 4 months | 6 | Complete temporary relief | No improvement | 13 months |
| 745 | 1 month | 5 | Complete temporary relief | Improvement | 15 months |
| 857 | 7 months | 3 | Not known | None made | 5 months |
| 986 | 3 months | 4 | Not known | None made | 7 months |
| 982 | 28 months | 2 | Not known | None made | |
| 977 | 8 years | 8 | Complete temporary relief | Slight amount of repair | 9 months |
| 1020 | 4 years | 1 | Only 1 treatment due to psychosis, refused more | X-ray showed no bone metas | 1 month |
| 1038 | 7 years | 6 | Complete permanent relief | Improvement | 6 months |
| 1057 | 10 months | 3 | No relief | None made | 6 months |
| 1058 | 6 years | 2 | Complete permanent relief | | 9 months |
| 1067 | 2 years | 2 | Complete temporary relief | None made | 5 months |
| 1109 | 6 months | 2 | Complete permanent relief | None made | 4 months |
| 1205 | 18 months | 1 | Partial relief | None made | 1 month |
| 1142 | 2 months | 2 | Not known | None made | 2 months |
| 1195 | 2 months | 1 | Did not relieve, treatment to skull | None made | 1 month |
| 1216 | 10 days | 1 | Complete temporary relief | None made | 3 weeks |
| 1229 | 9 years | 1 | No pain from metastasis | None made | 3 weeks |

TABLE III-1—CARCINOMA OF THE BREAST, LIVING—26 OF 104 CASES

| X-ray No, Hospital No | Name Age | Side | Bone involvement | Type | Diagnosed by | Other involvement |
|--------------------------|-------------|-----------|---|----------------------|-----------------|---------------------------------|
| 251 C-402 | F T 54 | R. | Right ribs, right and left clavicle, pelvis, right and left scapula, lumbar spine, right and left femur | O and O ² | Pain and X-ray | Scar, local glands |
| 317 C-455 | G K. 45 | R. | Right humerus | | Pain | Scar, local glands |
| 579 45601 | G M 42 | L | Lumbar spine, pelvis | O and O ² | Pain and X-ray | Local glands |
| 653 46847 | C. S 74 | L | Pelvis and lumbar spine, left femur | O and O ² | X-ray | Scar |
| 665 47046 | S M 57 | R. | Lumbar spine, pelvis | Osteoclast | Pain and X-ray | Liver |
| 679 Private | A N 37 | L | Left scapula, pelvis, lumbar spine | Osteoclast | Pain and X-ray | Local glands |
| 680 C-911 | L H 43 | R | Dorsal spine, left ribs, pelvis | O and O ² | Pain and X-ray | Lungs |
| 702 51848 | M F 69 | R. | Left calcaneum, left carpus, left ulna | O and O ² | Pain and X-ray | Skin, local glands |
| 713 47926 | E. B 54 | R. | Right hip, pelvis, lumbar spine | O and O ² | Pain and X-ray | Local glands |
| 724 53153 | L F 38 | L | Dorsal spine, right humerus, pelvis | Osteoclast | Pain and X-ray | Scar |
| 745 C-1132 | B Z 44 | R. | Pelvis and femur | Osteoclast | Pain and X-ray | Lungs, scar |
| 857 52797 | A M 42 | R | Right coxal bone | Osteoclast | Pain and X-ray | Scar, local glands |
| 986 52131 | A E. 42 | L | Pelvis and lumbar spine, left femur | Osteoclast | Pain and X-ray | Axillary glands |
| 982 51900 | F M 52 | Bilateral | Cervical and dorsal spine | Osteoclast | Pain | Scar and left side |
| 977 | C. R. 52 | R. | Left ribs, pelvis, femora, spine, and skull | O and O ² | Pain and X-ray | None demonstrated |
| 1020 52490 | J M 53 | L | Left ribs and sternum | | Pain | Local glands |
| 1038 52329 | L B 55 | R. | Pelvis, skull, sternum, right ribs, dorsal and lumbar spine | O and O ² | Pain and X-ray | Supraclavicular glands |
| 1057 92358 | M T 47 | L | Dorsal and lumbar spine | No X-ray exam | Pain | Local glands |
| 1058 92359 | L B 69 | R | Right ribs | Osteoclast | Pain and X-ray | None |
| 1067 53471 | H J 70 | L | Left femur, lumbar spine | Osteoclast | Pain and X-ray | None demonstrated |
| 1109 54102 | M G 46 | Bilateral | Dorsal and lumbar spine | X-ray neg | Pain | None demonstrated |
| 1205 | E. L. 46 | R. | Pelvis, right femur, lumbar spine | Osteoclast | Pain and X-ray | None demonstrated |
| 1142 | E. F. 58 | L | Pelvis, right femur | Osteoclast | Pain and X-ray | Local glands |
| 1195 Private | H H 55 | L | Right skull | Osteoclast | X-ray | Local glands |
| 1216 55258 | M C 37 | R. | Pelvis, right femur, right ribs | Osteoclast | Pain and X-ray | Liver local glands |
| 1229 55530 | H G 64 | L | Pelvis and lumbar spine | Osteoclast | Pain and X-ray | Local glands, skin, mediastinum |

²Osteoclastic and osteoblastic

TABLE IV-B—CARCINOMA OF THE BREAST, DEAD—23 OF 52 CASES

| X-ray No | Time from operation to X-ray treatment | Number of treatments | Pain | X-ray | Time followed |
|----------|--|----------------------|--|-------------|-------------------|
| 29 | 10 years | 3 | Complete temporary relief | None made | Died 6 months |
| 57 | 4 years | 1 | No treatment given to bones | None made | 10½ months |
| 69 | 2 years | 2 | Patient able to walk again (Christian Scientist) | None made | 16 months |
| 75 | 7 years | 6 | Partial temporary relief | Extension | 16 months |
| 203 | 6 months | 4 | No treatment given to bones | None made | 4 months |
| 288 | 1½ years | 5 | Complete temporary relief | Improvement | 6 months |
| 312 | 1 year | 1 | Partial temporary relief | None made | ½ month |
| 328 | Lump in breast one year | 1 | Complete temporary relief | None made | 2 months |
| 347 | Palliative, removed immediately | 1 | Bones not treated | None made | 1 month |
| 355 | 6 months | 3 | Bones not treated | None made | 8 months—accident |
| 382 | 1 year | 1 | Not known | None made | 2 months |
| 396 | 4 years | 6 | Complete temporary relief—able to be up 1½ years after treatment | None made | 27 months |
| 411 | Not operated on | 1 | Not known | None made | 7 months |
| 438 | 10 months | 1 | Not known | None made | 4 months |
| 594 | 4 years | 1 | Not known Treated outside | None made | 14 months |
| 606 | 2 years | 1 | Not known | None made | ¼ month |
| 657 | 2 years | 2 | Not known | None made | 11 months |
| 673 | 2 years | 2 | Not known | None made | 7 months |
| 707 | 1 year | 1 | Not known | None made | ½ month |
| 728 | 5 weeks | 2 | Complete permanent relief—up after 8 months in bed | None made | 11 months |
| 754 | 2 years | 1 | Not known | None made | 1 month |
| 1210 | 2 months | 1 | Partial temporary relief | None made | 2 months |
| 746 | 8 months | 2 | Not known | None made | 5 months |

TABLE IV-A—CARCINOMA OF THE BREAST, DEAD—23 OF 52 CASES

| X-ray No Hosp No | Name Age | Side | Bone involvement | Type | Diagnosed by | Other involvement |
|---------------------|-------------|------|--|----------------------|--------------------------|--|
| 29 36541 | A V 65 | R. | Dorsal and lumbar spine, pelvis | Osteoclast | Pain and X-ray | Lungs |
| 57 36968 | M J | R. | Scapula, humerus, cervical spine | Not known | Pain, X-ray made outside | Local |
| 69 37135 | A H | R. | Entire spine, left and right femora, pelvis | Osteoclast | Pain and X-ray | None demonstrated |
| 75 437935 | S H | R. | Left ribs, right humerus | Osteoclast | Pain and X-ray | Liver, opposite breast |
| 203 39435 | L B 61 | L. | Pelvis | Osteoblast | Pain and X-ray | Lungs, local glands |
| 288 C-350 | J M 41 | L. | Left femur, lumbar spine | Osteoclast | Pain and X-ray | None demonstrated |
| 312 41321 | J B 36 | L. | Left ribs, pelvis, right femur, and acetabulum | Osteoclast | Pain and X-ray | Lungs, skin nodules, scalp, local glands |
| 328 41518 | A D 63 | L. | Right femur, right pelvis, lumbar and dorsal spine | Osteoclast | Pain and X-ray | None demonstrated |
| 347 41504 | D T 38 | L. | Right femur and pelvis | Osteoclast | Pain and X-ray | Local glands |
| 355 40614 | M J 67 | R. | Dorsal spine and multiple fractures of vertebrae | Osteoclast | Pain and X-ray | Local glands, scar |
| 382 42208 | D B 44 | L. | Pelvis, lumbar spine, skull | Osteoblast | Pain and X-ray | Lungs and brain |
| 396 42588 | A T 46 | L. | Dorsal spine and pelvis (bedridden) | O and O ² | Pain and X-ray | None demonstrated |
| 411 42856 | M H 37 | R. | Skull, dorsal spine | Osteoclast | Pain and X-ray | None demonstrated |
| 438 43413 | A D 62 | R. | Left humerus, spine, pelvis, ribs | O and O ² | Pain and X-ray | None demonstrated |
| 594 45761 | A D 52 | R. | Lumbar spine, pelvis | O and O ² | Pain and X-ray | Skin—general |
| 606 46046 | C D 77 | R. | Right femur, spine, pelvis, ribs | Osteoclast | Pain and X-ray | Local glands |
| 657 46994 | L O 54 | R. | Left humerus and scapula, left femur, right knee | Osteoclast | Pain and X-ray | None demonstrated |
| 673 C-899 | E W 62 | R. | Dorsal spine | Osteoclast | Pain and X-ray | Generalized |
| 707 47884 | E F 44 | R. | Dorsal spine, left humerus, left femur, pelvis | Osteoclast | Pain and X-ray | Liver, lungs |
| 728 48146 | B J 40 | L. | Pelvis, sacrum, lumbar spine, right ribs | Osteoclast | Pain and X-ray | None demonstrated |
| 754 48432 | M D 46 | R. | Dorsal and cervical spine, skull | Osteoclast | Pain and X-ray | Lungs |
| 1210 55247 | H D 42 | R. | Cervical and lumbar spine, pelvis | Osteoblast | Pain and X-ray | None demonstrated |
| 746 | J W 42 | L. | Right ribs | | Pain—X-ray neg | General |

TABLE IV-B—CARCINOMA OF THE BREAST, DEAD—23 OF 52 CASES

| X-ray No | Time from operation to X-ray treatment | Number of treatments | Pain | X-ray | Time followed |
|----------|--|----------------------|--|-------------|-------------------|
| 29 | 10 years | 3 | Complete temporary relief | None made | Died 6 months |
| 57 | 4 years | 1 | No treatment given to bones | None made | 10½ months |
| 69 | 2 years | 2 | Patient able to walk again (Christian Scientist) | None made | 16 months |
| 75 | 7 years | 6 | Partial temporary relief | Extension | 16 months |
| 203 | 6 months | 4 | No treatment given to bones | None made | 4 months |
| 288 | 1½ years | 5 | Complete temporary relief | Improvement | 6 months |
| 312 | 1 year | 1 | Partial temporary relief | None made | ½ month |
| 328 | Lump in breast one year | 1 | Complete temporary relief | None made | 2 months |
| 347 | Palliative, removed immediately | 1 | Bones not treated | None made | 1 month |
| 355 | 6 months | 3 | Bones not treated | None made | 8 months—accident |
| 382 | 1 year | 1 | Not known | None made | 2 months |
| 396 | 4 years | 6 | Complete temporary relief—able to be up 1½ years after treatment | None made | 27 months |
| 411 | Not operated on | 1 | Not known | None made | 7 months |
| 438 | 10 months | 1 | Not known | None made | 4 months |
| 594 | 4 years | 1 | Not known Treated outside | None made | 14 months |
| 606 | 2 years | 1 | Not known | None made | ½ month |
| 657 | 2 years | 2 | Not known | None made | 11 months |
| 673 | 2 years | 2 | Not known | None made | 7 months |
| 707 | 1 year | 1 | Not known | None made | ½ month |
| 728 | 5 weeks | 2 | Complete permanent relief—up after 8 months in bed | None made | 11 months |
| 754 | 2 years | 1 | Not known | None made | 1 month |
| 1210 | 2 months | 1 | Partial temporary relief | None made | 2 months |
| 746 | 8 months | 2 | Not known | None made | 5 months |

TABLE V-A — CARCINOMA OF THE PROSTATE, LIVING

| X-ray No. Hosp No. | Name Age | Number of treatments | Bone involvement | Type | Diagnosed by | Other involvement |
|-----------------------|-------------|-------------------------|--|----------------------|-------------------|----------------------|
| 307 41156 | C. T. 66 | 4 | Right femur, pelvis, right ribs | O and O ² | Pain and X-ray | Abdomen |
| 370 Private | T. B. | 2 | Questionable metastasis to pelvis | Osteoclast | Pain and X-ray | Inguinal glands |
| 350 41880 | C. S. 62 | 1 | Pelvis, lumbar spine | Osteoblast | Pain and X-ray | Lungs |
| 485 44103 | F. C. 68 | 1 | Pelvis, lumbar spine | Osteoblast | Pain and X-ray | None |
| 674 48286 | E. F. 74 | 2 | Pelvis | Osteoblast | Pain and X-ray | None |
| 820 49275 | J. E. 55 | 1 | Pelvis | Osteoblast | Pain and X-ray | None |
| 921 30524 | T. T. 64 | 1 | Lumbar spine, pelvis | Osteoblast | Pain and X-ray | None |
| 901 50285 | S. O. 69 | 1 | Pelvis, lumbar spine, femora | O and O ² | Pain and X-ray | None |
| 945 51192 | C. B. 70 | 1 | Lumbar spine and pelvis | Osteoblast | Pain and X-ray | None |
| 941 52839 | L. H. 75 | 5 | Lumbar spine, pelvis, left ribs, left scapula, right clavicle | Osteoblast | Pain and X-ray | None |
| 1228 55486 | W. B. 67 | 1 | Lumbar spine, pelvis, ribs | O and O ² | Pain and X-ray | None |
| 1232 55055 | H. D. 64 | 1 | Pelvis | O and O ² | Pain and X-ray | None |
| 1237 55662 | J. B. 60 | 1 | Pelvis, lumbar spine | Osteoblast | Pain and X-ray | None |

CARCINOMA OF THE PROSTATE, DEAD

| | | | | | | |
|----------------|-------------|---|--|----------------------|-------------------|------------------------|
| 314 Private | F. K. | 1 | Pelvis, left femur | Osteoblast | Pain and X-ray | None |
| 380 42268 | G. B. | 3 | Pelvis, femora, lumbar spine | Osteoblast | Pain and X-ray | None |
| 345 41822 | P. R. 80 | 2 | Pelvis | Osteoblast | Pain and X-ray | None |
| 714 47740 | J. C. 73 | 1 | Pelvis | Osteoblast | Pain and X-ray | None |
| 285 Private | A. R. | 5 | Pelvis | Osteoblast | Pain and X-ray | Local glands |
| 282 40527 | H. S. 65 | 1 | Right ribs | Osteoblast | Pain and X-ray | None demon- strated |
| 304 41145 | C. P. | 1 | Lumbar and dorsal spine, pelvis | Osteoblast | Pain and X-ray | Lungs |
| 566 45457 | M. B. 81 | 1 | Lumbar spine, pelvis, femora | Osteoblast | Pain and X-ray | None demon- strated |
| 749 48394 | A. O. 65 | 1 | Pelvis, femora, ribs, lumbar and dorsal spine | O and O ² | Pain and X-ray | Lungs |

TABLE V-B — CARCINOMA OF THE PROSTATE, LIVING

| X-ray No | Effect of X-ray on urinary symptoms | Pain | X-ray | Time followed |
|----------|---|---------------------------|----------------|---------------|
| 307 | Increased difficulty | Partial temporary relief | Progression | 22 months |
| 370 | Urinary frequency reduced, patient able to work | Permanent relief | No progression | 3 months |
| 350 | Very poor condition | No relief | None made | 8 months |
| 485 | Temporary partial relief | Slight relief | None made | 4 months |
| 674 | Not known | Not known | None made | 3 months |
| 820 | Refused full-course treatment | No relief | None made | |
| 921 | Complete temporary relief | Complete temporary relief | None made | 4 months |
| 901 | Not known | Complete relief | None made | ½ month |
| 945 | Not known | Not known | None made | 10 days |
| 941 | Partial relief | Complete temporary relief | Progression | 10 months |
| 1228 | No relief | No relief | None made | 3 weeks |
| 1232 | No relief | No relief | None made | 1 month |
| 1237 | Partial relief | Partial relief | None made | 2 weeks |

CARCINOMA OF THE PROSTATE, DEAD

| | | | | |
|-----|----------------|-------------------------------|-------------|-----------|
| 314 | Not known | Partial temporary relief | None made | 8 months |
| 380 | Progression | No relief | Progressive | 7 months |
| 345 | Poor condition | No relief | None made | 3 months |
| 714 | Not known | Not known | None made | 1 year |
| 285 | Improvement | Partial temporary relief | Progression | 1 year |
| 282 | Not treated | Partial temporary relief | None made | 2 months |
| 304 | Not treated | Died one week after treatment | None made | 10 months |
| 566 | Not known | Not known | None made | 1 month |
| 749 | Not known | Not known | None made | 2 weeks |

RADIOLOGY

TABLE VI-A—CASE OF MELANOMA—1 OF 12 CASES

| X-ray No. Hospital No. | Name Age | Number of treatments | Bone involvement | Type | Diagnosed by | Other involvement |
|---------------------------|-------------|-------------------------|------------------|------------|-------------------|---------------------------------------|
| 571 45490 | M B 47 | 6 | Right rib | Osteoclast | Pain and X-ray | Lung, mediastinum, axillary glands |

CARCINOMA OF CERVIX AND UTERUS, DEAD—3 OF 165 CASES

| | | | | | | |
|----------------|-----------|---|--|------------|-------------------|-----------------------------|
| 710 39506 | C B 43 | 2 | Dorsal and lumbar spine, femur— pathologic fracture | Osteoclast | Pain and X-ray | Adnexa |
| 235 40000 | T R 63 | 1 | Left ileum, 2 years following opera- tion | Osteoclast | Pain and X-ray | Retroperi- toneal glands |
| 495 Private | D B 43 | 1 | Left innominate bone | Osteoclast | Pain and X-ray | |

CASES OF HYPERNEPHROMA, LIVING—2 OF 12 CASES

| | | | | | | |
|--------------|-----------|---|---------------|------------|-------------------|---------|
| 297 40481 | A J 55 | 2 | Skull | Osteoclast | X-ray | Lungs |
| 768 48554 | V W 51 | 3 | Right humerus | Osteoclast | Pain and X-ray | Abdomen |

CASES OF HYPERNEPHROMA, DEAD—3 OF 4 CASES

| | | | | | | |
|-------------|-----------|---|--|------------|-------------------|---------|
| 71 36620 | M S | 1 | Pelvis, left femur | | X-ray | Lungs |
| 469 | E C 48 | 1 | Dorsal spine, left ribs | Osteoclast | Pain and X-ray | Abdomen |
| 365 | P C 15 | 2 | Pelvis, femora, dorsal spine, right foot, skull | Osteoclast | Pain and X-ray | Lungs |

THYROID CASE, LIVING—1 OF 3 CASES

| | | | | | | |
|-----|-----|---|--------------------------------------|------------|-------------------|------------------------|
| 797 | C D | 4 | Dorsal spine, left femur, right ribs | Osteoclast | Pain and X-ray | None demon- strated |
|-----|-----|---|--------------------------------------|------------|-------------------|------------------------|

TABLE VI-B—CASE OF MELANOMA—1 OF 12 CASES

| X-ray No | Effect on lesion | Pain | X-ray | Time followed |
|----------|--|---------------------------|-------------|---------------|
| 571 | Temporary complete disappearance in lung | Complete temporary relief | Progression | 14 months |

CARCINOMA OF THE CERVIX AND UTERUS, DEAD

| | | | | |
|-----|-----------------------------|-----------|-----------|-----------|
| 710 | Complete disappearance | Not known | None made | 2 years |
| 235 | Infiltrated up into abdomen | Not known | None made | 10 months |
| 495 | Partial improvement | Not known | None made | 1 month |

CASES OF HYPERNEPHROMA, LIVING—2 OF 12 CASES

| X-ray No | Time from operation to treatment | Pain | X-ray | Time followed |
|----------|----------------------------------|---------------------------|---------------|---------------|
| 297 | 3 weeks | | Much improved | 9 months |
| 768 | 2 weeks | Complete temporary relief | None made | 4 months |

CASES OF HYPERNEPHROMA, DEAD—3 OF 4 CASES

| | | | | |
|-----|--------------|----------------|-------------|----------|
| 71 | None | Not known | None made | 2 weeks |
| 469 | 14 months | Not known | None made | 1 week |
| 365 | No operation | Partial relief | Improvement | 4 months |

THYROID CASE, LIVING—1 OF 3 CASES

| | | | | |
|-----|-----------|---------------------------|-----------|----------|
| 797 | 14 months | Complete temporary relief | None made | 7 months |
|-----|-----------|---------------------------|-----------|----------|

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TABLE VI-A — CASE OF MELANOMA—1 OF 12 CASES

| X-ray No, Hospital No. | Name Age | Number of treatments | Bone involvement | Type | Diagnosed by | Other involvement |
|---------------------------|-------------|-------------------------|------------------|------------|-------------------|---------------------------------------|
| 571 45490 | M B 47 | 6 | Right rib | Osteoclast | Pain and X-ray | Lung, mediastinum, axillary glands |

CARCINOMA OF CERVIX AND UTERUS, DEAD—3 OF 165 CASES

| | | | | | | |
|----------------|-----------|---|--|------------|-------------------|-----------------------------|
| 710 39506 | C B 43 | 2 | Dorsal and lumbar spine, femur— pathologic fracture | Osteoclast | Pain and X-ray | Adnexa |
| 235 40000 | T R 63 | 1 | Left ileum, 2 years following opera- tion | Osteoclast | Pain and X-ray | Retroperi- toneal glands |
| 495 Private | D B 43 | 1 | Left innominate bone | Osteoclast | Pain and X-ray | |

CASES OF HYPERNEPHROMA, LIVING—2 OF 12 CASES

| | | | | | | |
|--------------|-----------|---|---------------|------------|-------------------|---------|
| 297 40481 | A J 55 | 2 | Skull | Osteoclast | X-ray | Lungs |
| 768 48554 | V W 51 | 3 | Right humerus | Osteoclast | Pain and X-ray | Abdomen |

CASES OF HYPERNEPHROMA, DEAD—3 OF 4 CASES

| | | | | | | |
|-------------|------------|---|--|------------|-------------------|---------|
| 71 36620 | M S | 1 | Pelvis, left femur | | X-ray | Lungs |
| 469 | E. C 48 | 1 | Dorsal spine, left ribs | Osteoclast | Pain and X-ray | Abdomen |
| 365 | P C 15 | 2 | Pelvis, femora, dorsal spine, right foot, skull | Osteoclast | Pain and X-ray | Lungs |

THYROID CASE, LIVING—1 OF 3 CASES

| | | | | | | |
|-----|-----|---|--------------------------------------|------------|-------------------|------------------------|
| 797 | C D | 4 | Dorsal spine, left femur, right ribs | Osteoclast | Pain and X-ray | None demon- strated |
|-----|-----|---|--------------------------------------|------------|-------------------|------------------------|

tion, together with surgery, in selected cases, is the treatment of choice for hypertrophic scar and keloid.

Keloid, like scar tissue, arises from the corium and, also like scar tissue, is generally due to trauma. It has a predilection for certain portions of the body, the region of the sternum being most frequently infested. Next in order come the lobes of the ears and in those individuals who are susceptible to this scourge it may come anywhere that trauma breaks the skin.

Keloid is the nightmare of the plastic surgeon. Many times when he has done a very commendable piece of remodeling he is abashed, and sometimes criticized, for a condition over which he has no control, except possibly through the use of the prophylactic dose of X-rays given prior to the operation. This procedure, which was first used by Dr. Pfahler, is useful to a degree, although nothing seems, in some instances, to stop the formation of keloid in those susceptible to it.

Dr. H. L. Updegraff, reconstructive plastic surgeon, with whom I have been associated in the treatment of these conditions, uses the pre-operative prophylactic suberythema dose more and more in his work and thinks it has decreased to a great degree the number of keloids encountered. It is our opinion that if a scar is closely watched, and at the first indication of keloid is irradiated with monthly suberythema doses over a period of three or four months, this lesion will not become large and unsightly, yielding much more rapidly than in those cases in which no check is made at all or made only when the condition has become unbearable to the patient. Of course, the more recent a keloid is, the more easily it is righted.

H. Lyons Hunt, in *American Medicine*, sums up the treatment of keloid as follows: Until the advent of roentgen rays and radium, both surgery and medicine failed

numerably in producing a fair percentage of cures. Excision, thiosinamin, injection of formalin or of creosote oil, massage and pressure, introduction of digestive secretions such as bile, pancreatic juices, etc., all had their advocates but not cures, so it seems of little use to spend time in discussing this at any length. Of those pioneering in this field, William, Allen, Degravins, Pusey, Allen, Wickham, Hahn, Edwards, Taylor, and a few others did commendable work, but their technic varied and it was left to the roentgenologist to work out his own.

Of late we have used the following technic which seems to give very good results: 90 KV, 4 ma, giving 650 r units through 1 mm aluminum. This last is added to take care of the variation in tubes which has been worked out so nicely by Dr. A. W. Erskine, of Cedar Rapids. The dose may be repeated every month until recovery is complete or no further benefit is observed. We have been giving the equivalent of the above, but spaced out in weekly treatments, and in this way feel that we have retained patients who would otherwise have felt they were neglected. No reactions have been experienced at any time and the results have been satisfactory.

One such dose is given pre-operatively if operation is to be done and at monthly intervals, as above stated, following operation.

In those cases which are resistant to the X-ray, success has been had with the use of the water-cooled ultra-violet ray. Just what action ultra-violet has on these tissues is debatable, but the fact remains that the results are quite good, and the element of safety in its use is the factor that recommends it. In persons of the negro race, whose skin is so resistant to all forms of treatment, it can be pushed to success in cases in which other forms of treatment have failed or in which it would be unwise to push the X-ray further. Of course one must keep in mind the slowness with which

X-RAY TREATMENT OF KELOIDAL AND HYPERSTROPHIC SCARS¹

By BENJAMIN H SHERMAN, M.D., HOLLYWOOD, CALIFORNIA

K ELOID, first described by Alibert, is derived from two Greek words meaning "scar-form." Keloid, although it generally starts in an injured area, tends to spread from this area into the surrounding tissues in a claw-like shape. While it is a moot question as to just why it forms in one scar and not in another, some disputing that there is a so-called keloid individual, still the fact remains that keloid attacks some individuals while others who have undergone like injuries, whether from operation, burns, or what not, show no sign of this disease. There seems to be no real reason to burden the mind with the etiology of keloid, as the primary cause is unknown, aside from the fact that it is more prone to attack darker and thicker skinned individuals, the syphilitic and the tuberculous, following injury.

Burns about the mouth, eyelids, nose, neck, etc., may completely change the patient's looks or expression, generally to his detriment, and may interfere with function—this is especially true when they occur about the tear ducts or angles of the mouth.

Hypertrophic scar and keloid have a common etiology—trauma, yet their histologic structures are far separated. Hypertrophic scars tend to proliferate, but they do not extend beyond the border of the injury, while keloids tend to grow out in claw-like formations over healthy tissue, converting it into a formidable dermatologic problem.

Pathologically keloid is essentially a fibroma, arising out of the corium with small round cells that group themselves around the blood vessels, which, in the older keloid, become less numerous. The bundles of fibrous tissue run parallel to the long axis of the tumor, no glands follicles, or elastic

tissues are present in the growth, having been crowded out by the fibrous tissue.

There seems to be no distinction pathologically between the so-called true and false keloid, or new and old keloid, except that the cells are fewer in number in the latter and the blood vessels are somewhat atrophied.

Before beginning treatment of keloid or scars in general, better results will be obtained in all cases if one will take into consideration the following points:

- 1 Is syphilis a factor in this individual case?
- 2 Is tuberculosis a factor?
- 3 Does the individual have an obsession regarding this particular scar or keloid?

In the first instance it is to be insisted upon that a Wassermann be made regardless of age, social standing, or "previous condition of servitude," for obvious reasons. In the second instance these conditions in the tuberculous yield much less rapidly to treatment, and in the third instance those individuals who have an obsession as to their condition are apt to multiply their troubles many fold, it being a condition of the mind rather than a deformity of import. Although it may seem very small to us, to them it is of vast importance, and if it does not yield promptly they become most discouraged and in some cases have even committed suicide. One should be very guarded in his prognosis, never promising the patient relief, but, rather, giving him hope in other ways, for it is in this obstinate type of case which it takes months sometimes to relieve that patients are apt to become discouraged and to seek other treatment.

It seems to be the opinion of the profession generally that some type of irradia-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles, California, Dec. 1-5, 1930.

sponges, also cut to size. Then firm pressure approximating 30 mm of mercury should be applied until the area has healed. X-ray in suberythema, one-fourth doses every week until healing has entirely occurred offers a better result than any other method I have found to date.

DR SHERMAN (closing) I would like to make a statement about the treatment of these conditions, which probably accounts for patients' remaining with us until results were obtained. Instead of the monthly suberythema dose, they were treated at weekly intervals, dividing the doses so that the results were equivalent. In this way, patients retained their interest and also felt that we were interested in them and doing something for them.

The massive dose, so to speak, I think is probably best applied to those small hard lesions such as are frequently seen on the face.

Surgery was used in those cases in which the lesion was large, possibly one or two inches across and five or six inches in length, and it was thought best to remove a portion of the lesion, or, if possible, all of it, leaving a small linear scar instead of the rough contour which remains many times, especially following a burn. In some of these cases in which it was possible to remove all of the keloid, irradiation was used with good results as a prophylactic measure.

Some workers report good results with the use of radium, but it is probably the best rule to use such agents as you are most accustomed to in getting the desired result, in other words, it is best to use those agents the specific action of which you understand.

Success in treating these patients will depend upon your judgment as to which agent to use, be it X-ray, radium, or surgery, alone or in combination, that will best suit the particular case.

these conditions yield to any form of treatment, running as they do over a period of months. The radiologist must be sure to inform the patient that it will be months before appreciable relief can be had, and, too, the physician should not be influenced by sentiment to push the X-ray beyond the normal limits of dosage.

Radium is very acceptable for use in places inaccessible to the X-ray.

CONCLUSION

Prognosis should be guarded in every case of keloid or scar, be it ever so small or recent, being particularly cautious as regards the syphilitic type, the tuberculous, of erosions on the face, hard lesions, and lesions in the dark-skinned races.

The X-ray should not be pushed to the point of producing telangiectasis, in these instances, it would be better to use a less destructive wave length.

In the formation of scars there is a wide diversity of reactions. In some extensive injuries, whether lacerations, bruises, or burns, there are bound to be mutilating scars with contractions, while in others with the same extensive injury the deformity is surprisingly light. As a general rule, given the amount of surface involved together with depth of tissue involved, we can make a fairly accurate determination of the amount of scar tissue to be expected.

Probably the most important item in the treatment of these conditions is caution-caution in the application of whatever mode of treatment is used, fearlessness in calling upon the plastic surgeon when he is needed, for dividing responsibility may help in cases in which failure impends, and especially caution in the prognosis as it may save embarrassment later.

DISCUSSION

DR. T. M. BURROWS (Pasadena, Calif.) I think one should emphasize a point brought out by the speaker the importance of treating the cause of the keloid as well as the keloid

itself. In 200 cases of various benign and other lesions of the face which I removed with the circle knife, I noticed that scar formation was invariably associated with focal infection in the mouth or elsewhere. When these focal infections are treated successfully at the time or before the operations on the face, the scars are practically invisible. In cases having large keloids such as are found to occur in negroes we treated the focal infections, removed the keloids surgically, and treated the wound with X-rays or radium. This method has given very good results if the accompanying focal infections have been treated successfully.

A considerable number of patients refuse to have their teeth or tonsils removed. One woman had a malignant tumor on the end of her nose which I removed with the knife but an unsightly hypertrophic scar developed. She had chronic tonsillitis. The tonsils were removed after the scar developed and the scar disappeared within four weeks after the removal of the diseased tonsils.

Another point of interest is that circular open wounds leave the smallest scars on the face, while on the neck, the wound must be closed carefully or a scar will form.

DR. HOWARD L. UPDEGRAFF (Hollywood, Calif.) Keloid is the plastic surgeon's Sphinx. In spite of intensive observation and study by a great number of skilled observers, the why and wherefore of keloidal occurrence remains a mystery. It is almost a platitude that keloid occurs most frequently in the colored race. However, most of us are dealing with the white race and we see keloids entirely too often for our mental comfort.

The most efficacious means seems to be a combination of surgery and radiation. As a reconstructive surgeon, I have practically abandoned skin grafts on old keloidal bases. The surgical removal of hypertrophied scar tissue and definite keloidal growths must include all of the involved tissue—well into the subcutaneous layer.

These areas should be dressed with aero-form gauze (parresine mesh impregnated with 3 per cent ointment) cut to the size of the excised area. This should be covered with gauze

was instituted, except when repeated tapings of the joint failed to effect a cure

In Group 2, the arthritics, the prognosis is even better since the process is acute, the pain usually subsiding after a period of from four to six weeks under any form of therapy X-ray treatment was used only in the polyarthritic cases, for the relief of pain

It is in the osteo-arthritis (Group 3) that the prognosis is usually not favorable. Here the inflammatory process is chronic and refractory to treatment, the pain is severe, and lasts for months, or even a year. There is usually stimulation to the production of osteophytes at the borders of the articulating surfaces, permanently damaging the joint, so that, even with apparent cure of the ailment, recurrences are frequent. It is in this type of gonorrhreal joint complication, the type that has lasted more than a period of six weeks and has not yielded to the usual measures—rest, immobilization, attack of the urethral source of infection, vaccine, foreign protein injection, intravenous potassium iodide, or baking and massage—that X-ray treatment was instituted. The results, although they did not solve the problem, appeared somewhat better than those obtained with other measures, so that for the past few years it has become the practice at these hospitals to refer the difficult cases of gonorrhreal arthritis almost exclusively to the X-ray department for treatment.

Technic of Treatment—In the arthroses and arthritides, the treatment was Type "A," namely, 125 KV, 4 ma, 24 inch distance 0.25 mm copper, 1 mm aluminum and 2 cm of wood as filters, 20 cm area, 30 minutes every other day, alternating the anterior with the posterior, the internal with the external surface of the joint or joints, until each surface received four exposures over a period of from five to six weeks. At the completion of the series there was faint browning of the skin in light-haired individuals.

In the osteo-arthritis the treatment was Type "B," consisting of 155 KV, 4 ma., 24 inch distance, 0.5 mm copper, 1 mm aluminum, and 2 cm of wood as filters, 30 minutes every other day, alternating the anterior with the posterior, and the internal with the external surface, until each area received four exposures over a period of from five to six weeks. At the completion of the treatment there was slight browning in brunets and definite mild erythema in blonds. In some blonds, treatment was stopped a week or so earlier on account of the erythema.

Results—It is somewhat difficult to interpret exactly the results obtained, especially in view of the fact that the course of treatment was fully six weeks, and that time in itself was a very important factor in the treatment and final outcome of the disease. To obtain some notion, then, of its true efficacy, the average stay in the hospital of the 35 arthritic cases receiving X-ray treatment was compared with 35 others that had not received this treatment. Although these two groups are not strictly comparable (those receiving X-ray treatment being generally more severe), the treated cases showed an average stay of eight weeks as compared to nine weeks for the untreated. Only 3 of the 35 failed to obtain some relief from pain before the end of the second week of treatment.

Recurrence—The tendency to recurrence was determined by communicating with all the other United States Public Health Service Hospitals with reference to re-admission at a later date of the treated cases. From the reports of 23 of these hospitals up to July, 1931, and from our own files, we find 12 recurrences in the 35 cases treated, indicating a definite tendency in that direction.

In view of the lack of specificity in the action of X-radiation on gonorrhreal joints the expense both as to personnel and apparatus necessary for this type of treatment, and the recurrences within a 5-year period

THE X-RAY TREATMENT OF GONORRHEAL COMPLICATIONS IN MALES¹

By FRANK LIBERSON, M.D., Roentgenologist to the United States Public Health Service Hospitals, New York City

THREE is little that is definite in the literature on the therapeutic value of X-radiation in gonorrhreal complications. Wetterer, 1921, was probably the first to treat this subject in any comprehensive manner (1). His results in the inflammatory complications of gonorrhea—epididymitis, prostatitis, adenitis, etc.—were encouraging indeed, especially when treatment was instituted at an early date. His observations, however, were purely clinical there being no mention made of control groups or attempt to follow up the patients after treatment to determine recurrence of the complaints or ailments. Later workers, Fried (2), 1925, Grynraut (3), 1926, Sordello (4), 1926, Guhrauer (5) 1927, Martenstein (6), 1927, Gunsberger (7) 1928, Samek (8), 1930, and Kloekorn (9), 1930, corroborated in the main Wetterer's findings, using, however, much smaller doses, as is the modern trend generally. These observations, too, lack the scientific certainty that control groups and a follow-up system assure. A review, then, of the entire literature leaves some doubt as to the exact efficacy of X-ray therapy in the individual gonorrhreal complications.

The present study of the effect of filtered radiation in gonorrhreal complications began in 1925 at the United States Marine Hospitals at Staten Island and New York. It was not an outgrowth of any particular aim at scientific completeness, but, rather of a search for a more effective means of dealing with those cases refractory to the usual method of treatment at the time. After about one-half year's attack on these complications by means of X-ray with some meas-

ure of success, we began to deal similarly with the severer types of complications before they were considered refractory to the present date we have treated, controlled, and followed up a sufficient number of cases to give us some notion of its effectiveness. This series consists of 44 cases of painful heel, 35 of gonorrhreal arthritis, 20 of gonorrhreal adenitis, 12 of gonorrhreal epididymitis, and 8 of unyielding chronic gonorrhreal urethritis, treated during the period from January, 1925, to July 1931.

GONORRHEAL ARTHRITIS

(35 cases)

This is probably the most important complication of gonorrhea from the therapeutic point of view, especially in the severer mono-articular forms, since it is apt to be refractory to the usual treatment.

Roentgenologically, three types are commonly met with:

1 Simple arthrosis with swelling of the peri-articular joint space or tendon sheaths, or of the joint proper, with X-ray evidence of synovitis.

2 Arthritis in which there is slight diminution in joint space and some disuse atrophy (but no bony changes as seen by the X-ray) with or without effusion.

3 Osteo-arthritis, in which there is haziness over the joint, generalized peri-articular infiltration, diminution in joint space, and subsynovial bone absorption with or without periosteal reaction.

In the simple arthroses (Group 1 above) the prognosis for recovery within a period of from three to four weeks is good under any form of treatment or even without any. In those cases no X-ray treatment

¹Published by permission of the Surgeon General United States Public Health Service

These uniformly favorable results tend to show that X-ray therapy of the gonorrhreal heel makes for a shorter stay in the hospital and a more permanent result than the operative treatment, which is marked by prolonged pre-operative and convalescent care, and the frequency of recurrence (11, 12)

GONORRHEAL ADENITIS (BUBO)

(20 cases)

Our 20 cases of gonorrhreal bubo may be divided into three groups 8 were in the presuppurative stage, 6 in the suppurative stage (but were not incised at the time X-ray treatment was instituted), while 6 were operated upon and were draining

The first group (the presuppurative) was composed of cases that developed while the patient was in the hospital under treatment for posterior urethritis or some other gonorrhreal complication The X-ray treatment was Type "A," 125 KV, 4 ma., 50 cm distance, 0.25 mm copper, 1 mm aluminum, one-half hour every other day until three treatments were given (approximately two-thirds of an erythema dose) In six of these eight cases suppuration did not occur The other two suppurated, were incised, and progressed very much like the suppurating cases

In the second group (the suppurative, non-incised), the stay in the hospital was not shortened, the average being about 26 days, but the wounds were cleaner The treatment here was as above, two-thirds of an erythema dose being given in a five-day period

In the draining and incised cases, the treatment was repeated three weeks later, the results being cleaner wounds The stay in the hospital was shortened in some cases, but lengthened in an equal number, as compared with the untreated cases Our conclusion, then, after one year's trial, was that in cases of suppuration, with or without drainage, the value of the X-ray is insignif-

icant In the non-suppurative cases it has some value

GONORRHEAL EPIDIDYMITIS

(12 cases)

In the treatment of gonorrhreal epididymitis we were at first reluctant to use X-radiation because of the possible temporary sterilization that may follow its use All the patients consented, however, some even welcomed the possibility of sterilization The treatment consisted of 125 KV, 4 ma., 50 cm distance, 0.25 mm copper, 1 mm aluminum, every other day for three periods, alternating the front and back with the side of the epididymis (two-thirds of an erythema dose being given in five days) The treatment resulted in diminution or entire disappearance of the pain after five days, and some diminution of the swelling The average stay in the hospital, however, was three weeks, only one or two days less than the control groups This form of therapy was, therefore, discontinued the following year

UNYIELDING CHRONIC URETHRITIS

(8 cases)

Although it is not strictly a complication of gonorrhea, unyielding chronic urethritis with acute exacerbations is included as one of the end-results of gonorrhreal infection The treatment consisted of two-thirds of an erythema dose given to the perineum on three alternate days, using the same technic as for epididymitis, but shielding the testes Pain on micturition and also the discharge were diminished On the other hand, the fact that strictures were more numerous than in the control cases led us to abandon X-radiation as a routine procedure

SUMMARY

Deep X-ray therapy in the treatment of the various complications of gonorrhea in

in about one-third of the cases, it is recommended that X-ray therapy be employed only in the most severe cases, or those in which alleviation of pain is the main desideratum

GONORRHEAL PERIOSTITIS

(44 cases)

Periostitis, or spur-formation with an inflammatory soft-tissue infiltration over the spur, is the cause of the painful heel in gonorrhea. The treatment of 31 of these cases has been reported in a recent paper in the *Journal of Urology* (10).

From the roentgenologic viewpoint there are two readily distinguishable types of spurs.

The soft type, which is under 2 mm in size, is very difficult to see on a dark X-ray film, and leaves a smooth periosteal border after resorption. It is generally found in young adults with a history of gonorrhreal infection not more than one month before the appearance of the pain. The treatment suitable to this type of spur is Type "A" therapy, consisting of 125 KV, 4 ma, 24 inch distance, 0.25 mm copper, 1 mm aluminum, and 2 cm wood as filters, one-half hour every other day, alternating the internal lateral and the external lateral with the plantar surface of the os calcis. This treatment is continued for six weeks, each surface getting one treatment a week. At the completion of the full course of treatment, there is the faintest browning of the skin in very light-skinned patients.

The other type of spur, which is over one month in developing, or recurs after operative procedures, appears radiographically as

- (1) A simple bony projection with a sharply defined, dense, soft-tissue area over the spur
- (2) An irregular bony projection with erosion posterior to it

- (3) An irregular bony projection with erosion and periosteal tipping of the plantar surface, seen also in the region of the attachment of the tendo achillis

The treatment for this kind of spur is Type "B," consisting of 155 KV, 4 ma, 24 inch distance, 0.5 mm copper, 1 mm aluminum, and 2 cm wood as filters, one-half hour every other day, alternating the internal and external with the posterior surface of the os calcis for six weeks. At the completion of treatment there is a definite browning of the heel. In light-skinned patients we have to stop one or two weeks before the completion of a full course of treatment.

The results of the X-ray treatment of gonorrhreal spurs are uniformly encouraging. Of the 44 patients who had X-ray treatment to the gonorrhreal heel, 41 left the hospital with no complaint referable to it. They were able to jump from a height of 30 inches and land on the heels without feeling any discomfort. The other three patients were discharged without improvement—one for disciplinary reasons after only one treatment, another, after three treatments. A third had four weeks of treatment, but left the hospital against advice before a definite erythema was produced. Of the 41 cases, one had to have two courses of treatment before he was able to stand the test of jumping from a height of 30 inches without discomfort.

Although nothing definite can be said about the frequency of recurrence, we can state after a perusal of our follow-up files and the reports of 23 other hospitals of the United States Public Health Service that although 12 of the treated cases were readmitted for other conditions, not a single one who was fully treated complained of pain in the heel. One patient did have a recurrence of the pain three months after treatment, but the pain was atypical being mostly in the tendo achillis.

THE APPARENT THERAPEUTIC EFFECT OF THE ROENTGEN RAY UPON THE CLINICAL COURSE OF ACUTE MASTOIDITIS (PRELIMINARY REPORT)

By RAPHAEL SCHILLINGER, M.D., BROOKLYN, N.Y.

THE clinical course of acute mastoiditis appears to take a turn for the better after exposure of the infected mastoid to the roentgen ray. The turn is marked by a syndrome of favorable action, characterized by a drop in temperature, absence of pain and insomnia, diminution in the amount of discharge, and a change in the character of the discharge from purulent to mucopurulent. The frequency of this observation, and the surprising regularity with which it is induced, leads one to believe that a therapeutic action is exerted by the roentgen ray upon the infected mastoid. A compilation of statistical data of cases definitely diagnosed as acute mastoiditis, both clinically and by X-ray examination, which were subsequently cured without operative interference, and of others, which were operated

upon, is given in this report, as a result of which certain conclusions and recommendations are made.

LITERATURE

We fail to find any case reports in the literature, describing intentional therapeutic use of the roentgen ray in acute mastoiditis. Granger (1) mentions a favorable effect on infants who present signs of infection and occlusion, but not of softening and destruction, which effect was incidental to the making of the roentgenograms. Many of these went on to resolution and cure, which prompts Granger to believe that neither mere hazard nor coincidence was responsible.

In closing his discussion of his paper, Granger says, very significantly "After seeing from 50 to 60 patients with mastoiditis

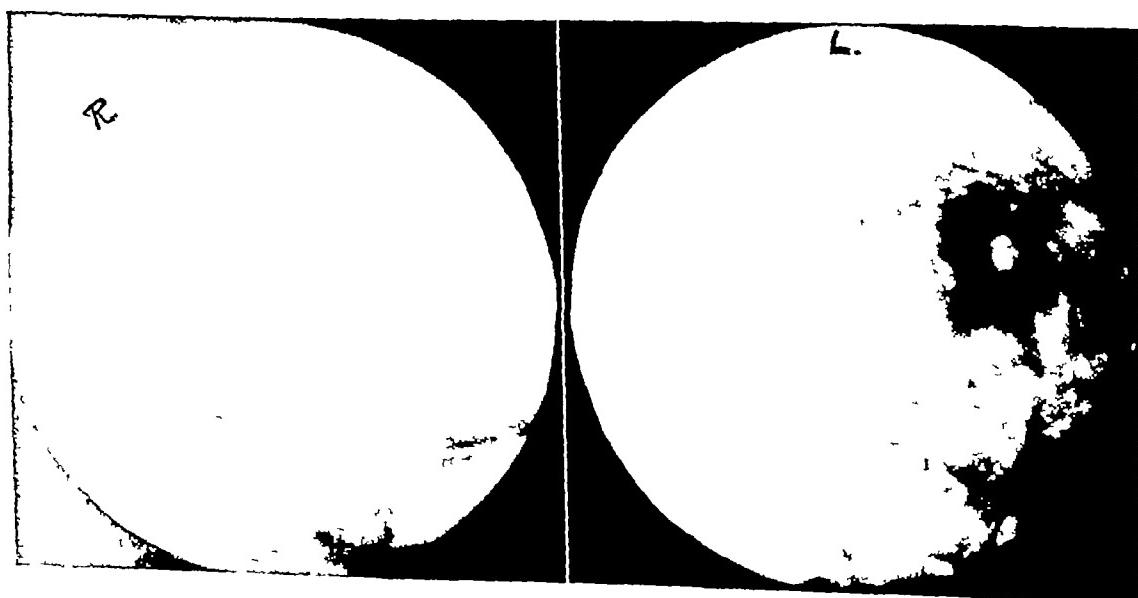


Fig 1 Case 6, Table I—Scarlet fever otitis media, followed by mastoiditis. The plate shows the left mastoid occluded, with softening and destruction of some trabeculae in the posterior border cells. The ear returned to normal three weeks after the second exposure.

119 males was studied over a period of six and one-half years, with special consideration for recurrences and for comparison with untreated control groups. In the order of efficacy, X-ray therapy appears uniformly effective in the painful heel due to periosteal spur, it has a limited field of usefulness in the treatment of refractory gonorrhreal joint complications, especially for the relief of pain, but in gonorrhreal epididymitis, adenitis, and urethritis the results were not significant.

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To Study Cosmic Rays with Balloon-borne Instruments—Balloons bearing automatic recording instruments, floating free to heights hitherto unattained in such studies, are planned for the further investigation of cosmic radiation by Dr Robert Andrews Millikan, of the California Institute of Technology. The launching place for these unmanned explorers of upper air has not been announced, except that it will be in a different latitude from that used for similar experiments in 1922, when Dr Millikan and his colleague, Dr I. S. Bowen, sent up recording balloons from Kelly Field, Texas.

In these tests ten years ago, one of the balloons reached a height of 15.5 kilometers, or 9.6 miles. Dr Millikan hopes to send this year's balloons to greater heights, carrying their feather-weight equipment of recording electroscopes, barographs, and thermometers

into regions where the blanket of air is far less dense and correspondingly more penetrable to the cosmic rays.

Investigations at great heights, as well as under great depths of water, have been considered of much importance in the study of cosmic radiation. With other rays, there is a difference in their penetrating power, depending on their wave length—the shorter the wave length, the "harder" and more penetrating the radiation. The same rule may be presumed to hold for cosmic rays. Dr Millikan has stated as a result of his earlier studies that he has been able to distinguish a cosmic-ray "spectrum" of several wave lengths. Possibly the higher ascensions planned for this year will carry his instruments out into a region where they can pick up "softer" rays of greater wave length, that are stopped by the deep atmospheric blanket that surrounds the earth.—*Science Service*

was given on each of the two succeeding days and a third therapy dose was given a week later. Recovery was uneventful, function returning to normal after the second therapy dose.

Fig. 3 (center) Case 17, Table I.—The two large areas of coalescence are here outlined.

Fig. 4 (below) Case 17, Table I.—Twenty months later, Nature's effort at repair is quite evident. The two coalesced areas are now the site of early sclerosis. The ear is perfectly normal in function and appearance.

without bone destruction get well with fractional doses of the X-rays, one cannot feel that it is an accident."

The same author, in a previous paper (2), makes the same comment about improvement incidental to making the roentgenograms, and adds that, after a period of from two to five days of watchful waiting "If the condition shows no sign of clearing up, or if the clinical examination indicates that it has become worse, other radiographs are made, and invariably these show signs of softening or destruction."

We are heartily in accord with the observations and statements made by Granger, who deserves much credit, more particularly because his observations are those of a radiologist and not of an otologist. From the otologist's point of view, we can add experiences similar to Granger's, and also state that, in many cases, even though softening and destruction did take place, if the clinical picture was improved by repeated X-ray exposures, postponement of operation was allowed, and eventually complete recovery without operation was made in approximately 85 per cent of our cases.

Desjardins (3) gives a very comprehensive summary of the various explanations of the mode of action of irradiation on inflammatory conditions, referring to favorable effects of the roentgen ray upon many, including otitis media. He strikes a very important note in speaking of treatment by irradiation in saying, "Even now, however, this method of treatment is not used as widely as it might be, probably because its value is not generally realized."

In the hope that this report may act as a guide and stimulus for the use of X-irradiation in acute ear infections, and more partic-

ularly for acute mastoiditis, we respectfully offer our experiences.

AUTHOR'S CONTENTION

That a certain percentage of all cases of acute mastoiditis recover without any special therapy is undoubtedly true. That a favorable effect on acute mastoiditis is exerted by the roentgen ray is also true. The use of irradiation on cases of acute mastoiditis in which operation is indicated will, in a large majority, cause resolution and cure without operation. We have observed what we believe to be a therapeutic effect on a number of cases of acute mastoiditis, even those with evidence of bone destruction, and we dared to subject some of them to repeated X-ray exposures in an effort to answer the following questions:

1. If a favorable effect on the symptoms of acute mastoiditis is seen after exposure to the roentgen ray for diagnostic purposes, could this effect be repeated by subsequent exposure, when, and if, the original symptoms recurred?

2. If, in a case of acute mastoiditis we have diagnostic plates which allow us to temporize, would it be possible to observe the progress of the bone disease on serial plates, and, if the progress was that of increasing bone pathology, in spite of persistent benefit symptomatically, might we expect resolution of the infection, without loss of valuable time?

Such questions were evolved from curiosity aroused by cases which showed unexpected benefit following diagnostic exposure to the roentgen ray, of which a few representative histories are given here as examples.

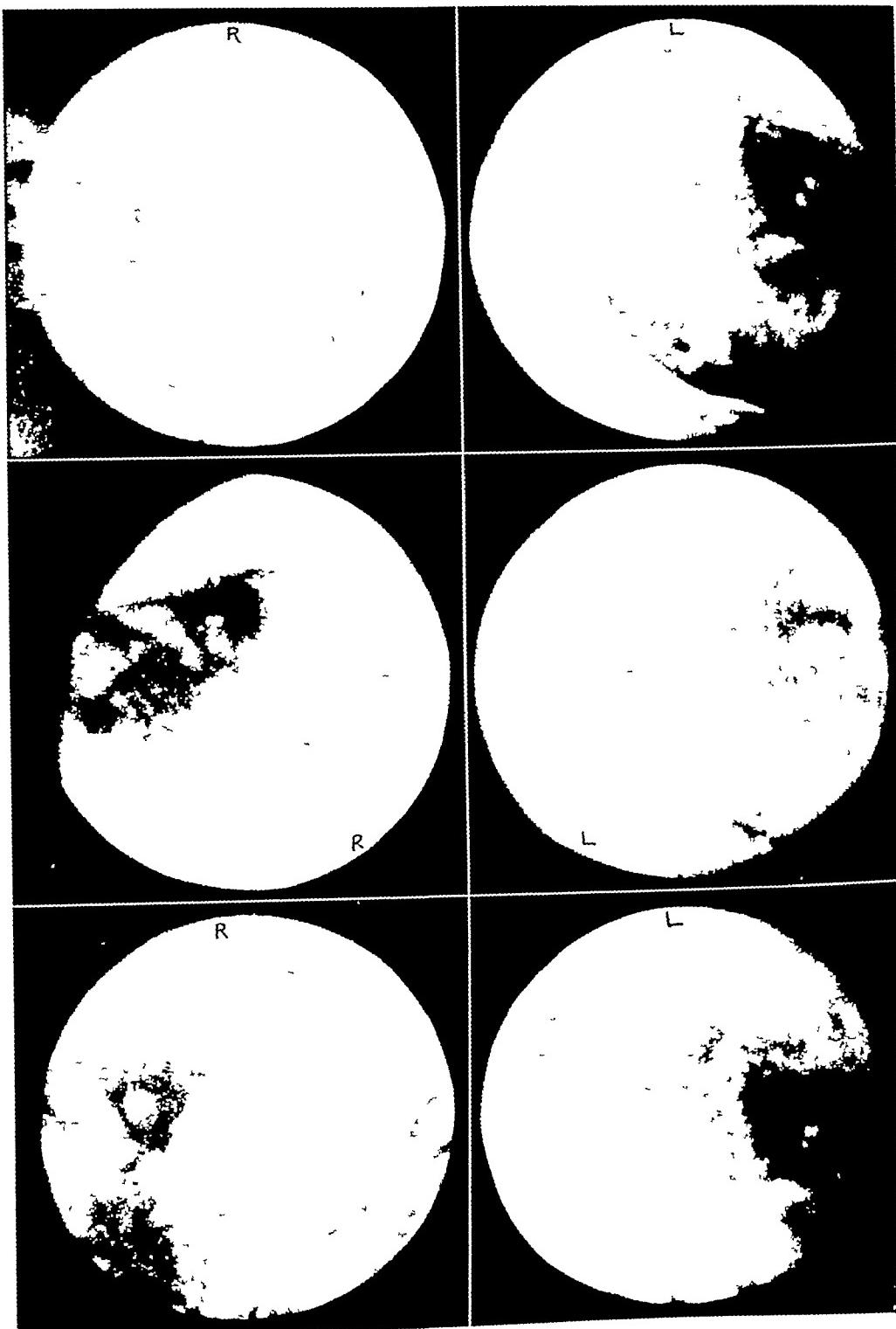


Fig 2 (above) Case 17, Table I—Twenty-four days after incision of the drum, two large areas of coalescence in the right mastoid, peri-antral clouding, and general fuzziness were noted. A therapy dose

(Continued on next page)

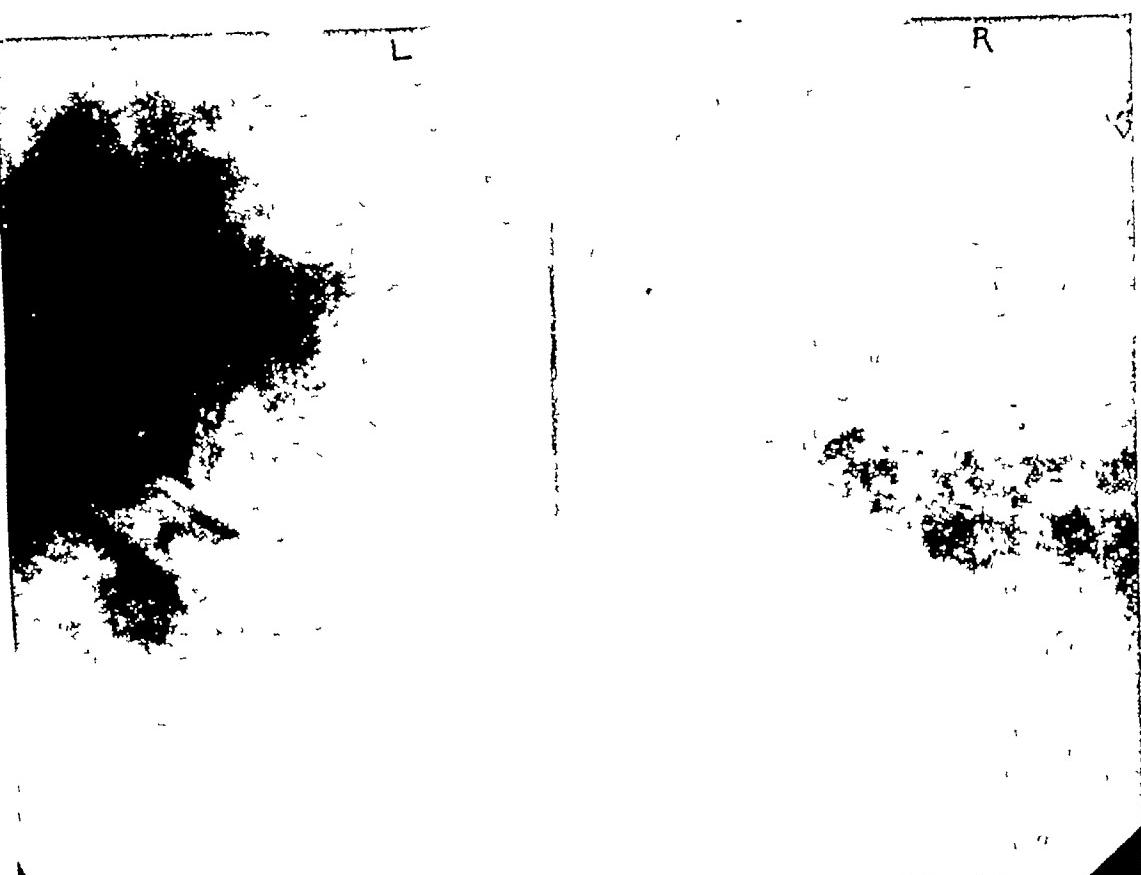


Fig 6 Case 24, Table I.—There is marked clouding of the right mastoid, with softening and probably destruction. The otoscopic picture was that of severe mastoiditis, for which several otologists indicated operation, as we also did. Recovery was prompt after the second exposure.

April 5, the drum, canal, and function having returned to normal.

B P, age 40 years, Oct 1, 1924. The patient complained of sharp pains in both ears, especially at night. Both ears had been discharging for nine weeks, following spontaneous perforation. Diagnostic plates of the mastoids were made, and the pain disappeared at once. Two days later the ears were dry.

SCOPE OF WORK

We have observed a large number of cases with histories such as the three described above. Many were cases of severe otitis media, while others, beyond any question, were surgical mastoiditis. For lack of control cases, this report will not concern itself with the large number of cases that

received but one roentgen-ray exposure. We shall deal exclusively with those cases observed in our office practice that have been examined roentgenographically on two or more occasions, and either resolved to the state of being cured, or else came to operation.

A series of 38 cases is tabulated, each one of which presented, at one time or another, a sufficient combination of cardinal symptoms, otologic signs, and laboratory findings, along with roentgenographic evidence to indicate mastoidectomy. There is considerable difficulty involved in the preparation of a table or chart that will permit the description of all the signs and symptoms in each case. Therefore, we have tabulated the significant treatment data and made comments wherever they were deemed advisable. Certain factors common to all the cases on

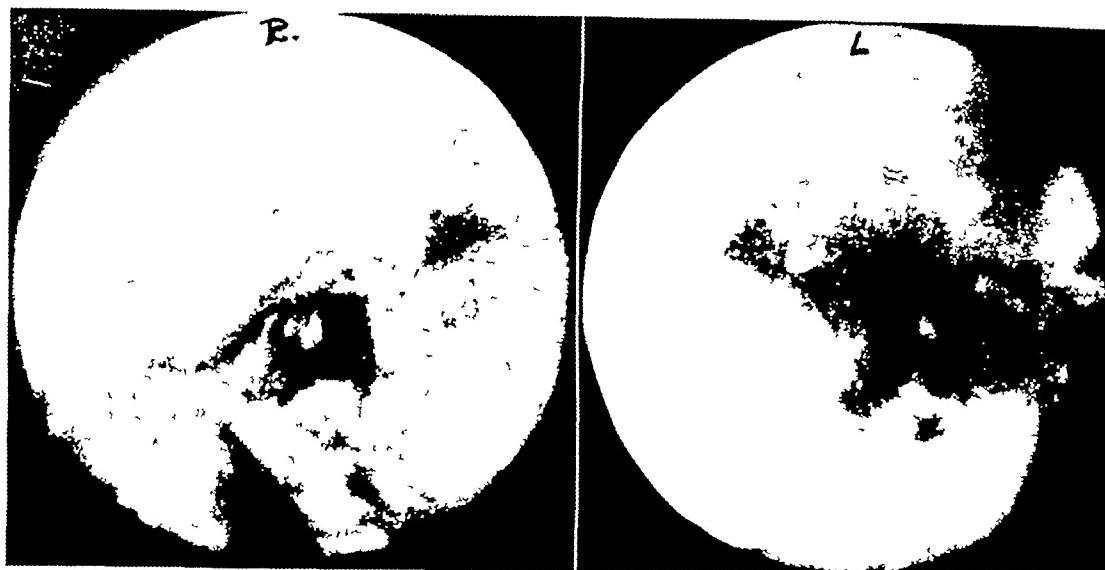


Fig 5 Case 23, Table I.—This plate shows marked clouding of the mastoid in an infant. The clinical picture of mastoiditis was severe. The ear returned to normal five days after the second exposure.

Mrs P F, age 32 years. Paracentesis of the right drum was performed April 12, 1923. A week later the patient developed severe mastoid pain, headache, insomnia, and a temperature of 103° . The discharge was purulent and profuse. The drum was puffy and red, and the canal fundus was contracted. On April 19, the patient was hospitalized for operation. The urine was negative. The blood count showed 4,500,000 red blood cells, 14,800 white blood cells, and 80 per cent polymorphonuclears. X-ray examination showed a large cellular mastoid, markedly云ed, with softening of many cell walls. The temperature, pain, and headache disappeared immediately after X-ray exposure. Because myocarditis made this patient a poor risk, and on account of the favorable turn in the clinical picture, operation was deferred. Otoscopic examination the next day showed general improvement. Four days later insomnia and pain reappeared, and the temperature rose to 101° . The mastoids were again examined roentgenologically. The right one showed more softening than before, but the temperature, pain, and insomnia promptly

disappeared following this second exposure, and discharge diminished considerably. The patient was sent home from the hospital on April 30, with the following otoscopic findings: scant discharge, no fundus contraction, drum pink and flat, no tenderness. Office examination on May 5 showed the right drum healed and normal in color and position and the patient felt perfectly well. Three weeks later the ear function was normal.

I M, age 10 years, March 17, 1924. There was a history of discharge from the right ear for one month, which had been more profuse a few days preceding examination. The drum was red and puffy, and there was marked sagging of the posterior superior canal wall and marked tenderness over the entire mastoid cortex. Diagnostic plates were made, showing marked clouding of a cellular mastoid. Operation was advised, to be performed the next day, but the patient was so markedly improved over night that operation was deferred. The pain and tenderness disappeared, the canal picture improved, and the patient was discharged from observation and treatment on

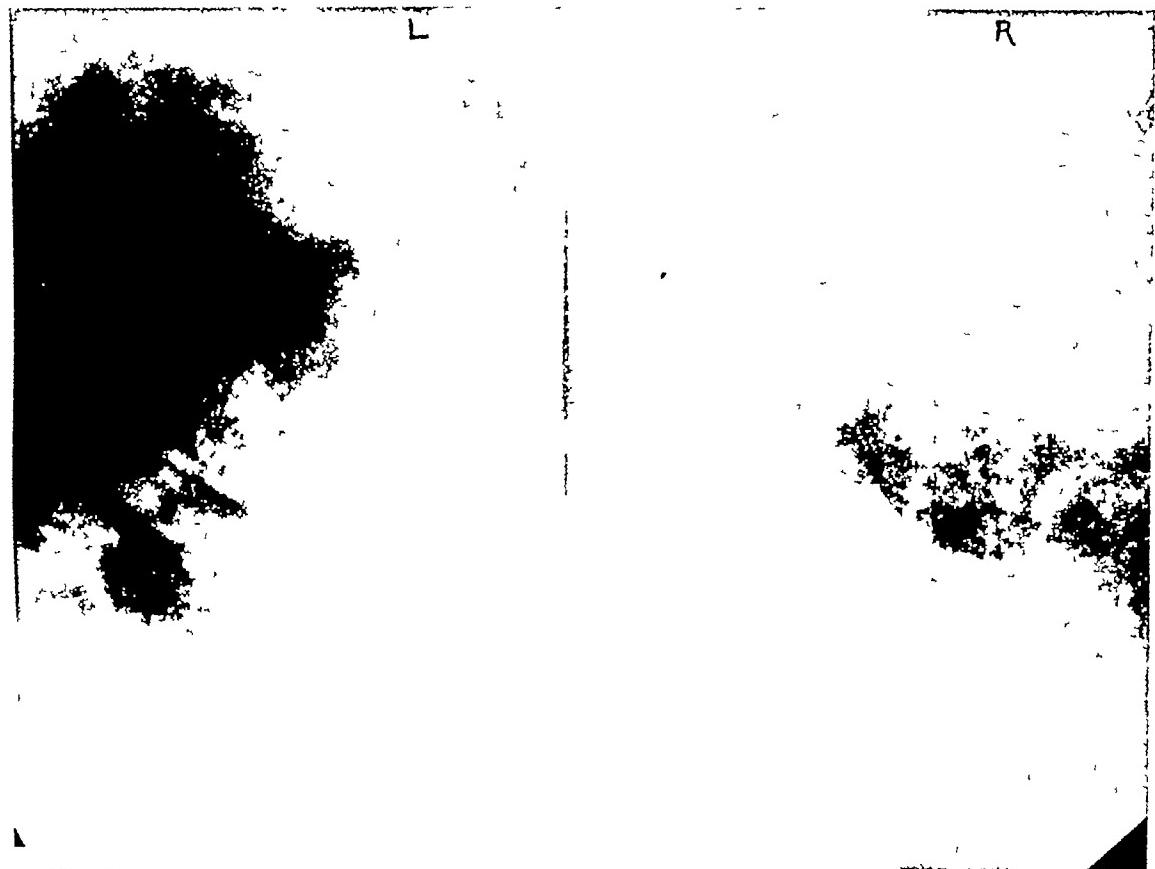


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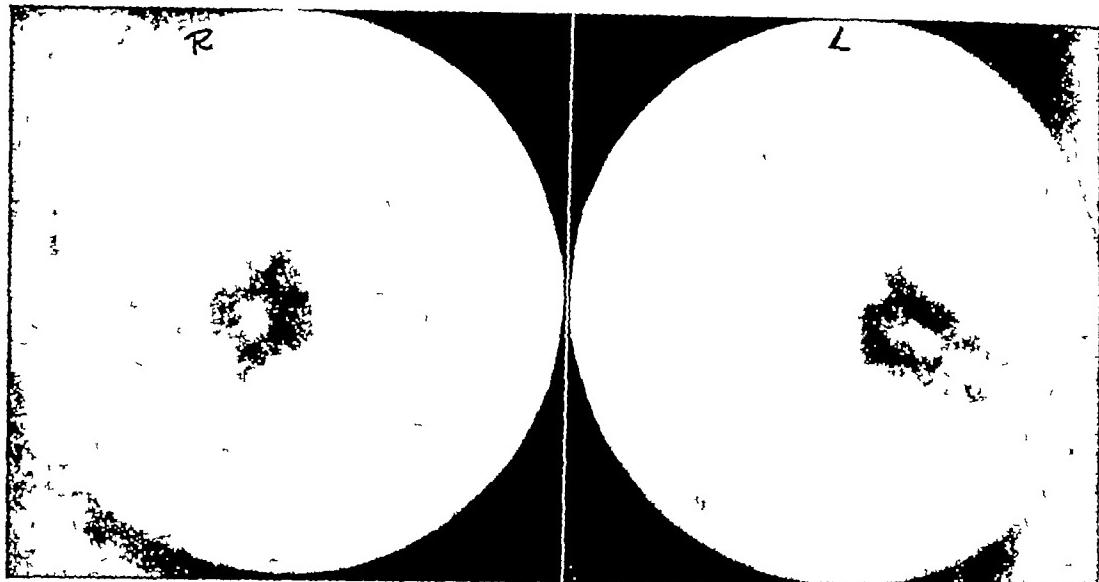


Fig 7 Case 25, Table I.—The right mastoid, infantile cellular type, is markedly occluded. The ear became normal five days after the second exposure.

the day of the first X-ray exposure may be described here.

All cases in this series presented red, puffy drums, the amount of edema of the drum membrane varying from a marked bulge to a nipple which hung from the roof to the floor of the canal, obscuring the rest of the drum. In all but 11 cases the canal fundus was contracted. The middle ear discharge could be increased in quantity by finger pressure on the internal jugular vein in all but 13 cases. There was exquisite tenderness over the entire mastoid cortex in 20 cases. There was exquisite tenderness over the antrum and tip in 11 cases, and marked tenderness over the antrum in seven. There was marked periosteal thickening in one case. There were pain and headache in 28 cases, and insomnia in all but seven. In the 38 cases, the sexes were equally represented. The nutrition was good in 17 cases, fair in 20, and poor in one. The ear infection resulted from the following diseases:

| | | | | | | | |
|---------------|---|---|---|---|---|---|----------|
| Rhinitis | — | — | — | — | — | — | 23 cases |
| Grippe | — | — | — | — | — | — | 5 cases |
| Tonsillitis | — | — | — | — | — | — | 3 cases |
| Scarlet fever | — | — | — | — | — | — | 2 cases |
| Measles | — | — | — | — | — | — | 2 cases |
| Pansinusitis | — | — | — | — | — | — | 1 case |

Swimming was the etiologic factor in one case, and, in the last case, irrigation of the nose for ozena set up the ear infection. The right mastoid was involved in 17 cases, the left, in 19 cases, and both mastoids in two cases. In only three cases had there been previous ear disease.

COMMENTS

Case 7.—The patient entered the hospital for operation, but X-ray examination there relieved symptoms. The ear cleared up and function returned to normal.

Case 10.—The patient developed a nipped drum, pain, and insomnia, accompanied by a profuse discharge, two weeks after the first exposure. The second exposure cleared all symptoms and within 48 hours the ear was dry.

Case 17.—The patient slept well after the first exposure, but retained sagging and tenderness until after the second exposure. X-ray film made 20 months later showed sclerosis in the coalesced area (Figs 2, 3, and 4).

TABLE I—CASES OF ACUTE MASTOIDITIS CURED WITHOUT OPERATION,
FOLLOWING TWO OR MORE EXPOSURES TO THE ROENTGEN RAY

| Case | Name | Age | Paracentesis or spontaneous perforation | Duration of earache before paracentesis or perforation, days | Temperature range before first X-ray exposure | Duration of discharge before first X-ray exposure, days | Interval between first and second X-ray exposures, days | Interval between second and third exposures, days | Duration of discharge after first X-ray exposure, days |
|------|------|-----|---|--|---|---|---|---|--|
| 1 | P F | 32 | P | 3 | 100-103 | 10 | 5 | | 21 |
| 2 | P A | 35 | P | 4 | 99-101 | 5 | 4 | | 40 |
| 3 | I M | 10 | S | 3 | 100-102 | 30 | 3 | | 18 |
| 4 | S W | 11 | S | 3 | 101-102 | 18 | 10 | | 23 |
| 5 | G R | 21 | P | 2 | 100-101 | 9 | 5 | | 14 |
| 6 | R J | 11 | P | 4 | 101-102 | 21 | 7 | | 30 |
| 7 | M G | 42 | S | 1 | 101-102 | 4 | 15 | | 34 |
| 8 | G E | 4 | P | 3 | 100-101 | 18 | 11 | | 21 |
| 9 | W S | 12 | P | 3 | 101-102 | 3 | 4 | | 13 |
| 10 | B S | 4 | P | 3 | 101-103 | 4 | 15 | | 17 |
| 11 | W T | 3 | P | 5 | 100-101 | 26 | 3 | | 8 |
| 12 | B Z | 6 | P | 4 | 100-101 | 17 | 3 | | 7 |
| 13 | M G | 26 | P | 1 | 100-101 | 8 | 7 | | 13 |
| 14 | A M | 33 | P | 3 | 100-101 | 13 | 3 | | 1 |
| 15 | B L | 49 | S | 7 | 101-102 | 16 | 2 | | 11 |
| 16 | C S | 5 | S | 1 | 101-102 | 8 | 3 | | 9 |
| 17 | R F | 14 | P | 2 | 102-103 | 24 | 1 T | 1 T* F | 10 |
| 18 | H S | 3 | S | 7 | 101-102 | 14 | 2 | | 14 |
| 19 | E R | 3 | S | 3 | 100-101 | 21 | 7 | | 10 |
| 20 | S K. | 46 | P | 3 | 100-104 | 2 p | 3 | | 7 |
| 21 | A G | 70 | P | 6 | 100-101 | 16 | 2 T | 3 T* | 12 |
| 22 | L W | 18 | S | 4 | 101-102 | 4 | 3 | | 10 |
| 23 | C N | 2 | S | 3 | 99-100 | 14 | 4 | | 9 |
| 24 | G W | 6 | S | 3 | 100-102 | 9 | 4 | | 14 |
| 25 | M S | 2 | P | 3 | 100-102 | 10 | 2 | | 7 |
| 26 | R G | 55 | S | 7 | 100 | 21 T* | 3 | | 1 |
| 27 | S B | 3 | S | 2 | 101-106 | 20 T* | 3 T* | | 14 |
| 28 | M G | 2 | P | 2 | 101-104 | 18 | 4 T* | 7 | 20 |
| 29 | S H | 5 | P | 6 | 100-101 | 10 | 3 | 3 | 11 |
| 30 | R R | 5 | P | 3 | 100-104 | 6 p | 4 T* | 7 | 14 |
| 31 | A S | 30 | P | 2 | 100-101 | 5 | 3 T* | 3 | 8 |
| 32 | M K. | 2 | P b | 2 | 102-103 | 5 | 4 | 6 | 19 |
| 33 | T K. | 6 | P | 5 | 101-103 | 5 | 3 | 10 | 17 |
| 34 | M S | 3 | P | 2 | 101-102 | 7 p | 4 T*p | 5 T*p F | 14 |
| 35 | B B | 29 | P | 5 | 101-102 | 47 | 1 | 1 F | 32 |
| 36 | I K. | 7 | P | 2 | 100-103 | 10 | 3 | 4 T* | 15 |
| 37 | E L | 8 | P b | 4 | 101-102 | 10 | 3 | 4 T* | 13 20 |
| 38 | I S | 26 | P | 4 | 100-101 | 30 | 2 | | 4 |

Each X-ray exposure means two plates each side

T—Therapy dose

T*—Therapy dose plus two plates each side

P—Paracentesis

S—Spontaneous perforation

F—Fourth exposure

b—Bilateral

p—Portable X-ray apparatus used

Case 20.—The portable X-ray apparatus was used at the patient's home on account of his temperature (104°), severe pain, and

insomnia, which were unrelied by opiates. Remarkable relief followed the X-ray exposure.

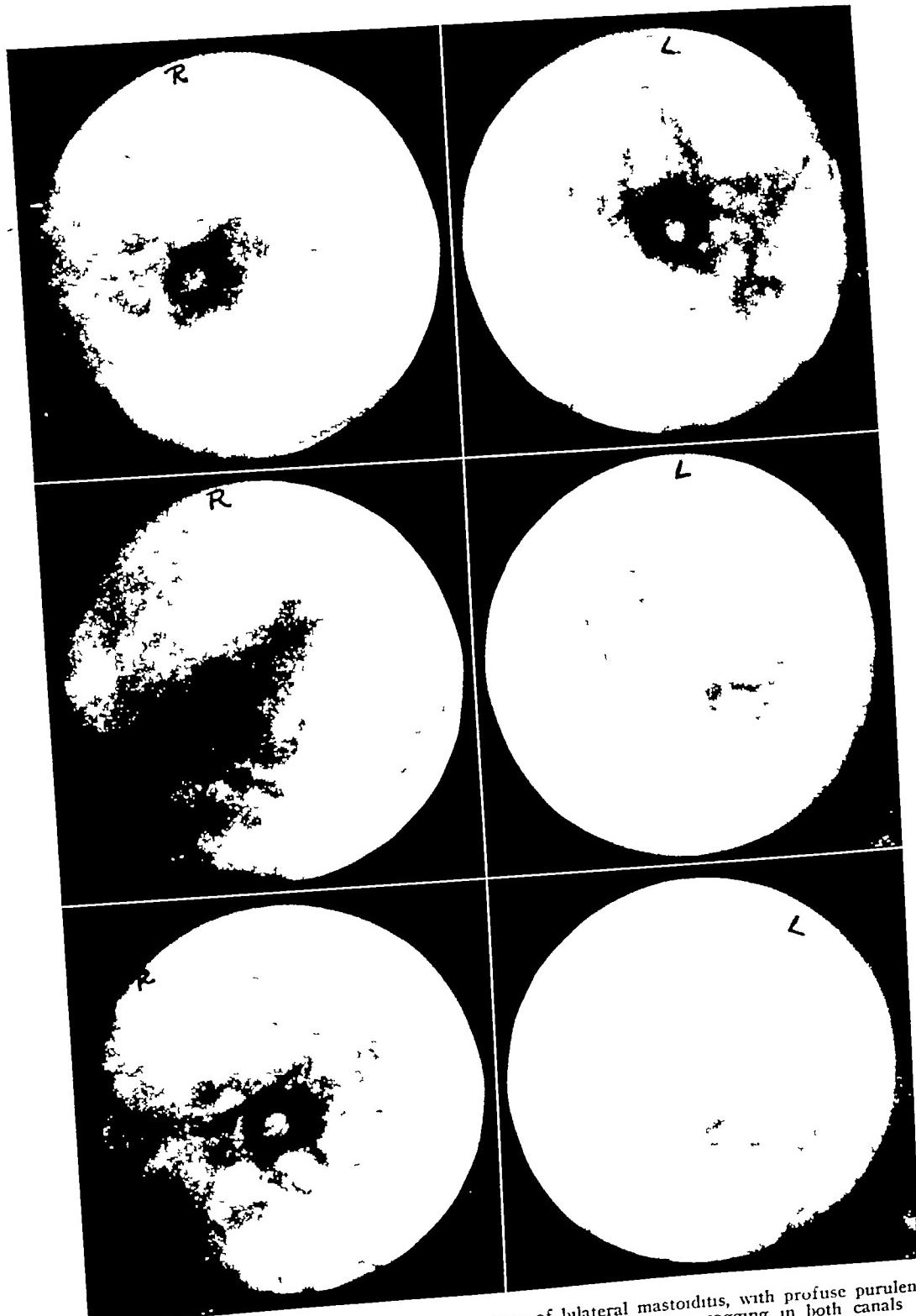


Fig 8 (above) Case 32, Table I.—This is a case of bilateral mastoiditis, with profuse purulent discharge from both ears. Both drums were red and nipped, and there was sagging in both canals. *(Continued on next page)*

and insomnia, and exquisite tenderness over both mastoids were among the symptoms. The morning temperature on the day of exposure was 103° , while that on the day following was 100° . The right mastoid is occluded throughout, fuzziness of the cell walls denotes softening. The left mastoid is smaller, of the infantile type, the peri-antral region is clouded and the cells are occluded. Aeration was present only in one large posterior cell. The emissary vein is visible on both sides, being more clearly so on the right.

Fig 9 (center) Case 32, Table I—Eleven days after Figure 8 was made. Just prior to this exposure, the right ear showed a profuse discharge, an increase in discharge on jugular pressure, a nippled edematous drum, and a marked sagging of the posterior and superior canal walls. The temperature was 101° . Periosteal thickening was present. The left ear was nearly dry and the drum almost normal in appearance. The temperature dropped to 99.8° after this exposure. This plate shows, in the right mastoid, increased bone pathology, destruction being evidenced by several areas of coalescence. The emissary vein is more prominent than before. The left mastoid shows increased aeration and less clouding in the peri-antral region, with beginning definition of the peri-antral cells.

Fig 10 (below) Case 32, Table I—Nineteen days after Figure 9. The ears were dry and the drums had returned to normal. The temperature was normal and the patient slept, played, and ate well. The plate shows better aeration in both mastoids, which is more evident in left. Cell definition is becoming clear in the right mastoid. Evidently, the otologic signs of recovery precede the X-ray signs by a considerable period of time.

Case 30—A streptococcus hemolyticus infection was present. The white blood count was 15,000. The same disease occurred in the other ear three weeks later, resolution and cure taking place after three X-ray exposures.

ANALYSIS OF TABLE I

In all cases, each X-ray exposure was followed by relief of the pain, tenderness, and insomnia within 24 hours. In all cases the temperature dropped to normal or close to normal within 24 hours. In all cases the discharge was lessened, and was changed from purulent to mucopurulent. Four cases showed sagging after the first exposure, five showed sagging after the second exposure, but in all these cases it cleared up subsequently. Ten cases received a therapy dose, the average time for cessation of discharge following the therapy dose being six days. There were no complications of any kind subsequent to any of the X-ray exposures.

Interval between first and second exposures—average number of days, 3-4

Interval between second and third exposures—average number of days, 5

Interval between third and fourth exposures—average number of days, 3

Subsequent to the first exposure, 25 ears were dry within two weeks, 15 were dry in from two to six weeks.

Subsequent to the second exposure, 31 ears became dry within two weeks, nine required two weeks or more to become dry.

CONTROL CASES

A series of seven cases is now presented in Table II, all of which came to operation after two or more roentgen-ray exposures. Incidentally, they were all females.

DISCUSSION

The cases which were operated upon deserve discussion individually for their special features.

Case 1 The child had been ill with whooping cough for five weeks. Earache and temperature of 105° for three days indicated paracentesis. A mild pneumonia followed for about eight days. Diagnostic X-ray films, made 20 days after paracentesis had been performed, showed moderate clouding of the right mastoid. This exposure was followed by less discharge and restful sleep. A week later, there was pain, accompanied by temperature of 100.2° . The periosteum was thickened, the drum red and swollen. A second X-ray exposure showed softening and destruction. The posterior superior canal wall was sagging, the discharge was increased on jugular pressure. Upon operation, the findings were bone softened, no free pus, several coalesced

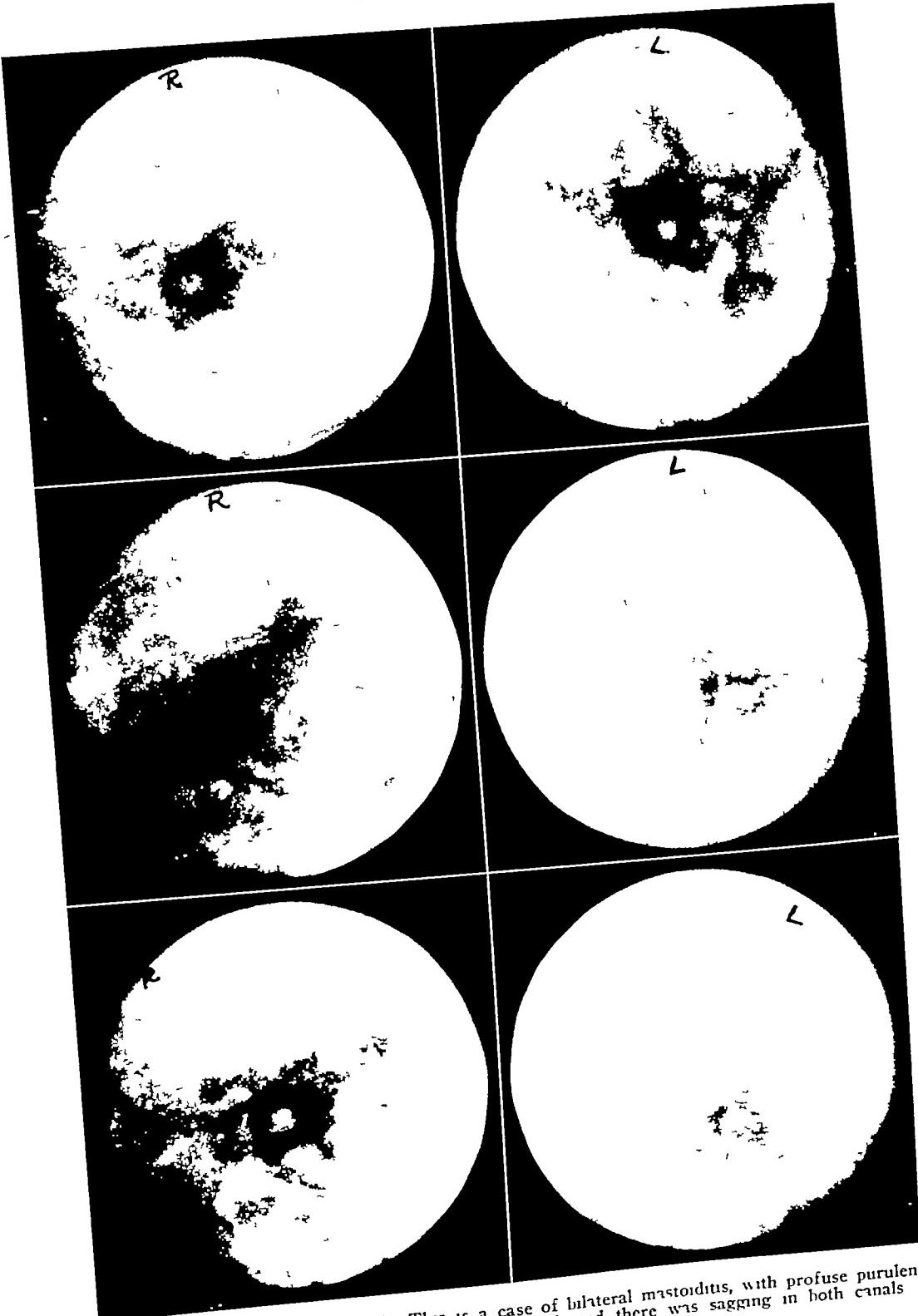


Fig. 8 (above) Case 32, Table I.—This is a case of bilateral mastoiditis, with profuse purulent discharge from both ears. Both drums were red and nippled, and there was sagging in both canals. Pain

(Continued on next page)



Fig 11 Case 34, Table I—Scarlet fever the plates were taken at home with portable apparatus Note that the left mastoid cells are completely occluded and the sinus plate prominent, with softening throughout, also there is dilatation and prominence of the emissary vein

paracentesis X-ray examination showed clouding of the left mastoid. She reacted well to this exposure, but the nose was discharging profusely in spite of regular maxillary antrum irrigations. Subsequent X-ray examinations of the mastoid showed destruction. The patient slept well and felt well, but ran a low-grade temperature; therefore, operation was performed to relieve the low-grade sepsis. Free pus was found in several large coalesced areas. Recovery was uneventful.

Case 6 This patient became very septic after a follicular tonsillitis, running a saw-tooth temperature between 100 and 105°. X-ray examination showed occlusion of both mastoids five days after incision of the drums. She did not react favorably to the first exposure, and a second exposure four days later showed destruction in the right mastoid. Operation was performed on the right mastoid. The temperature dropped from 104° to normal and stayed normal thereafter. The left ear continued to discharge, but became dry 11 days after a third exposure, or 40 days after incision. This

was a case of acute fulminating mastoiditis which did not show any effect from X-ray exposure and was relieved only by surgery. Both ears showed about the same severity of infection, and we feel that the recovery of the left ear was due to early intervention on the right side as well as the final touch of the third X-ray exposure.

Case 7 A young woman, who was poorly nourished, was very septic following a severe tonsillitis. Saw-tooth temperature, pain, and insomnia were unrelieved by X-ray exposure. The patient exhibited a drawn, anxious facies. No one could deny surgical help in this case of true fulminating, septic mastoiditis. The streptococcus hemolyticus was recovered from the mastoid wound.

These seven cases constitute the total number upon which we have operated subsequent to two or more X-ray exposures.

DOSAGE

As early as 1924 we had noted favorable changes in the clinical course of acute mastoiditis following roentgenographic exami-

TABLE II—CASES OF ACUTE MASTOIDITIS WHICH CAME TO OPERATION,
FOLLOWING TWO OR MORE ROENTGEN-RAY EXPOSURES

| Case | Age | Paracentesis or spontaneous perforation | Duration of earache before paracentesis or perforation, days | Temperature range before first X-ray exposure | Duration of discharge before first X-ray exposure, days | Interval between first and second X-ray exposures, days | Interval between second and third X-ray exposures, days | Interval between first X-ray exposure and operation, days |
|------|-----|---|--|---|---|---|---|---|
| 1 | 3 | P | 3 | 100-105 | 20 | 7 | 3 | 11 |
| 2 | 12 | S | 1 | 99-100 | 18 | 6 | | 10 |
| 3 | 20 | S | 2 | 101-103 | 4 | 4 | | 8 |
| 4 | 49 | S | 1 | 99-100 | 30 | 7 | | 8 |
| 5 | 24 | P | 3 | 100-103 | 5 | 5 | 3 | 13 |
| 6 | 4 | P b | 3 | 100-105 | 5 | 4 | 20 L | 4 |
| 7 | 24 | P | 4 | 100-104 | 4 | 1 | | 2 |

P—Paracentesis

S—Spontaneous perforation

L—Left side

b—Bilateral

areas filled with polypoid granulation tissue. Microscopic examination of this tissue showed fibroblastic granulations throughout. One cannot say whether or not this child would have recovered with more roentgen-ray exposures. Recovery after mastoideectomy was rapid and uneventful.

Case 2 The child reacted very well to both exposures, but, on the day of the second exposure, developed the Griesinger sign, which indicated interference with the sinus circulation. Operation was performed, and a large perisinus abscess was found, the sinus lying close up to the antrum. The white count before operation was 22,000, with 94 per cent polymorphonuclears (Fig. 12).

Case 3 This young woman was septic, and remained septic, due to a streptococcus hemolytic infection. Insomnia and pain were influenced by the X-ray exposure for only about ten hours. Her temperature varied several times a day, ranging from 101° to 103°. The tenderness was always

exquisite along the posterior border of the mastoid, and, when operation was performed, we found pure pus confined solely to several large posterior cells. Recovery was very prompt.

Case 4 The woman had had a discharging ear for one month. The drum healed and she felt well, but came to us for a check-up. The drum was normal in appearance, but the canal fundus was markedly narrowed. X-ray examination showed several areas of destruction. The patient slept well and had no temperature. Six days later she experienced pain behind the ear, and an evening rise in temperature. Roentgenographic examination again showed the same areas of destruction. Operation was advised and performed, disclosing a large perisinus abscess with granulations on the sinus about 2 cm in length. Recovery was rapid.

Case 5 One week postpartum, this patient required paracentesis of her left drum. She had a very severe tonsillitis and pan-sinusitis. Pain and insomnia continued after

- (d) Lessened quantity of discharge
 - (e) Change in the character of the discharge from purulent to mucopurulent
- 2 When, and if, the original symptoms recur, another exposure to the roentgen ray is given, then, in the great majority of cases, the syndrome of favorable action recurs, after this manifestation, resolution of the mastoid infection may be expected

3 Third and fourth exposures to the roentgen ray may be necessary in the more stubborn cases to secure resolution of the infection, especially in cases which show increasing bone pathology on X-ray examination, providing each exposure is followed by the syndrome of favorable action

4 A dosage ranging from between that required for making two plates of each mastoid to a 25 per cent erythema dose seems to be optimum for the apparent therapeutic effect Such dosage is considered one exposure

5 From experiences described herein and otherwise, we deem it advisable to attempt roentgen-ray therapy for acute mastoiditis under the following circumstances

- (a) when there is edema over the mastoid, or perforation of the cortex,
- (b) when there is extensive destruction of the mastoid process as shown on the roentgenogram,
- (c) when, in acute fulminating mastoiditis, roentgen-ray exposure fails to induce the syndrome of favorable action,
- (d) when the patient is diabetic, and there is evidence of bone destruction, even though the clinical picture is mild,
- (e) when the Griesinger sign is present, indicative of perisinus abscess or sinus thrombosis,
- (f) when the roentgenogram shows a cellular mastoid with the sigmoid sinus extending more anteriorly than usual, so that it impinges upon the antral

region, plus a marked clouding or softening The strong possibility of perisinus abscess formation should lead one to operate

- (g) when there is lowered resistance and low-grade sepsis, and serial plates show progressive destruction, and when further toxemia might seriously impair the recuperative power of the patient,
- (h) where there are symptoms of sinus thrombosis or phlebitis, meningitis, labyrinthitis, or brain abscess

CONCLUSIONS

1 If exposed on two or more occasions, acute mastoiditis, without bone destruction, frequently resolves under the influence of the roentgen ray

2 If exposed on two or more occasions, acute mastoiditis, with bone softening and destruction, may resolve under the influence of the roentgen ray

3 The roentgen ray exerts an influence upon acute mastoiditis which we have termed a syndrome of favorable action In most cases, this influence is followed by resolution of the infection, and it is, therefore, considered a therapeutic agent In some cases, even though this influence is experienced, operative interference is indicated

RECOMMENDATIONS

1 It may be advisable, as a prophylactic measure against mastoid disease, to treat acute otitis media by X-radiation at the end of the first week of discharge, and at three-day intervals thereafter, for three exposures, all told This formula is chosen arbitrarily from our experience at the present time

2 Once again, a plea is made for closer co-operation between the roentgenologist



Fig 12 Case 2, Table II.—Note the prominent lateral sinus in the right mastoid plate. The anterior sinus wall lies close to the antral region. Operation, which was indicated on account of the Griesinger sign, disclosed a large perisinus abscess.

nation. Prior to this date, only one plate of each mastoid was taken at each roentgen-ray examination, but, from this date on, two plates of each side were made at each roentgenographic examination. It is only since this change in routine that the favorable results herein reported were observed. For this reason we believe that the amount of irradiation incidental to making one plate of each mastoid is below the dosage required to produce the favorable effect.

The amount of irradiation used on the above cases may be judged from the following statement of technic employed on a standardized X-ray machine:

For diagnostic plates Ma, 30, time, one-third second to two seconds for each plate, depending on the age of the patient, focal distance 25 inches, gap, 4 inches, Law position, cone, 3 inches, two plates each side.

The therapy dose mentioned, and marked "T" in Table I, is 25 per cent of an erythema dose, given as follows Ma, 7.5,

time, 50 to 90 seconds, focal distance, 16 inches, gap, 6.5 inches, Law position, cone, 3 inches, one fiber filter. The pathologic ear is placed nearer the tube, as it then receives the greater amount of irradiation.

We have used this "T" dose in a few cases to determine whether or not it offers a more rapid resolution of the pathologic process; it was also used in cases that exhibited more severe clinical symptoms.

SUMMARY

1 In over 85 per cent of our cases, the roentgen ray caused an apparent change, within 24 hours after exposure, in the clinical picture of acute mastoiditis, affecting the temperature, pain, insomnia, and the amount and character of the discharge. This syndrome of favorable action is characterized by:

- (a) Lowered temperature
- (b) Cessation of pain
- (c) Absence of insomnia

- (d) Lessened quantity of discharge
- (e) Change in the character of the discharge from purulent to mucopurulent
- 2 When, and if, the original symptoms recur, another exposure to the roentgen ray is given, then, in the great majority of cases, the syndrome of favorable action recurs, after this manifestation, resolution of the mastoid infection may be expected

3 Third and fourth exposures to the roentgen ray may be necessary in the more stubborn cases to secure resolution of the infection, especially in cases which show increasing bone pathology on X-ray examination, providing each exposure is followed by the syndrome of favorable action

4 A dosage ranging from between that required for making two plates of each mastoid to a 25 per cent erythema dose seems to be optimum for the apparent therapeutic effect. Such dosage is considered one exposure.

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region, plus a marked clouding or softening. The strong possibility of perisinus abscess formation should lead one to operate.

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1 It may be advisable, as a prophylactic measure against mastoid disease, to treat acute otitis media by X-radiation at the end of the first week of discharge, and at three-day intervals thereafter, for three exposures, all told. This formula is chosen arbitrarily from our experience at the present time.

2 Once again, a plea is made for closer co-operation between the roentgenologist

and the otologist, because such co-operation must be conducive to a better understanding of the treatment of acute mastoiditis, a diminution in the percentage of cases coming to operation, and the development of an optimum dosage formula for the roentgenographic treatment of mastoiditis

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Blocks of Millions of Atoms Make Up Solid Matter—The matter that seems to ordinary eyes so solid and unbroken is actually made of blocks, somewhat like a tile floor, each block made of several million atoms, Dr Francis Bitter, of the Westinghouse Research Laboratories, has just established for the first time through magnetic researches

Reporting to the American Physical Society, Dr Bitter described his experiments that upheld the previous theory that contends such block structure in solids exists

A magnetic powder was suspended in a liquid which was allowed to evaporate on a shiny surface of the metal cobalt. As the liquid evaporated a regular lace-work appearance was produced by the grouping of the particles. As these deposits were arranged in the form of hexagons, the Doctor concluded that the blocks of the metal itself had just

this hexagonal arrangement. Magnetization of the cobalt specimen changed the pattern to a series of not quite parallel lines, showing that the blocks had become differently arranged under the influence of the magnetic force. Irregularities in the pattern were produced, he believes, by impurities in the metal

This brick or mosaic structure provides the key to some of the most baffling problems about the strength and electrical resistance of solids

Dr Bitter's discovery was not accidental but followed logically from a long series of theoretical investigations in which he studied what would be the consequences of such a block structure in solids

It is of interest, furthermore, that Dr Bitter is the son of Karl Bitter, internationally famous sculptor—*Science Service*

RADIOTHERAPY OF PITUITARY TUMORS

By WILLIAM HARRIS, M.D., and HERMAN SELINSKY, M.D.

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THE use of the roentgen ray as a therapeutic procedure in the treatment of pituitary tumors was first instituted by Gramegna and Béclère over twenty years ago. The more recent reports in the literature by Sgalitzer (1), Béclère (2, 3), Heinismann (4) and others are indicative of the widespread and accepted use of this form of therapy.

It is not our purpose to go into the historical difficulties in the treatment of pituitary tumors. It is sufficient to state that glandular and surgical methods have not always been rewarded by gratifying results. Hence, an addition to the therapeutic armamentarium which proves its value is an important contribution.

The early successful efforts obtained with roentgen rays in treating hypophyseal tumors have been amplified by the favorable results noted in this country and abroad, e.g., Bailey (5), Borak, Grant (8), Sgalitzer (1). The experience thus gained enabled the observers to a certain extent also to predicate the type of tumor with which they were dealing by the type of response to the roentgen ray (radiosensitivity). Thus, cystic tumors of the pituitary are known to be highly radioresistant to deep X-ray therapy, while the eosinophilic adenomas respond with fair promptness (Sgalitzer, 1). This observation explains to some degree the great variability in the results obtained.

Our present study is limited to thirteen cases in which the clinical picture of tumor in the pituitary region was manifested by visual disturbances, headache, dyspituitarism, and radiographic changes in the sella turcica.

The salient features of the thirteen cases are best illustrated by the accompanying tabulation.

COMMENT ON TABLE

(A) *Predominating Symptoms*

- 1 Headache in five cases
- 2 Visual disturbances in eleven cases (limitation of fields or diminution in visual acuity)
- 3 Polydipsia and polyuria in five cases
- 4 Acromegaly or adiposo-genital dystrophy in eleven cases
- 5 Menstrual disorders in seven of ten women
- 6 Somnolence in three cases

(B) *Sex and Fertility*

Of the thirteen cases reported above, ten were females. As might be expected, menstrual irregularity or cessation of menses was a frequent symptom, occurring in seven patients. Of the nine married patients in this series, eight had children before the onset of symptoms while the ninth practised contraception. The male patients suffered from impairment of libido and potency.

(C) *Sella Turcica Changes*

All cases except No. 3 and No. 11 showed definite erosion of the sella turcica.

(D) *Type of Dyspituitarism*

Although evidence of a mixed type occurred in some cases, the classification was based upon the preponderant symptomatology. Cases Nos. 1, 2, 4, 6, 9, 12, and 13 were classified as hypopituitarism, while Cases Nos. 3, 5, 7, 8, and 11 belonged to the group of hyperpituitarism. Case No. 10 did not show dyspituitarism but, in view of

RADIOLOGY

TABLE ILLUSTRATING THE SALIENT FEATURES OF THIRTEEN CASES OF TUMOR
IN THE PITUITARY REGION TREATED BY RADIOTHERAPY

| Designation of subject | | | Symptoms | Findings | Treatment | Results | Date of last examination | Notes |
|----------------------------------|-----|-----|---|---|---|--------------|--|---|
| No | Age | Sex | | | Operation | Radiotherapy | | |
| 1737 I Adm Dec., 1925 | 29 | ♀ | Headache, failing vision, polydipsia, polyuria, transitory hemianesthesia, somnolence. Onset, 8 years | Hypopituitarism, obesity, optic atrophy, hemianopsia, bitemporal hemianopia, visual acuity—10/200 O.D. 20/50 O.D. Sella turcica, enlarged | Subsellar decompression, with intranasal radium application | 4 courses | Vision improved, extremities smaller, less somnolence, polydipsia and polyuria diminished, mentally more alert. Visual acuity 10/15 O.U. Hemianopsia reduced to quadrantic defect | March, 1931 Patient able to do housework |
| 1504 II Adm Oct., 1925 | 31 | ♀ | Progressive loss of vision, amenorrhea, gain in weight, polyuria. Onset, 3 years | Primary optic atrophy, incised sinuses, tolerance, diminished deep reflexes. X-ray of skull, negative | None | 4 courses | Initial improvement only, vision better, menses returned twice (Dec., June, 1926). Recently impairment of vision recurred. Otherwise unchanged. | April, 1931 Patient refused operation, craniopharyngeal pouch cyst. One child |
| 3827 III Adm Mar., 1929 | 26 | ♀ | Aromegaly, hypertrichosis, menstrual irregularity. Onset, 1½ years | Acromegalic features, normal visual fields, sella turcica enlarged, somnolence | None | 1 course | More alert, extremities smaller, tics markedly less pronounced, menses regular but scanty, memory better | December, 1931 Now attends Teachers' Training School |
| 3876 IV Adm Apr., 1929 | 45 | ♀ | Visual impairment. Onset, 2 years | Bilateral optic nerve changes | None | 3 courses | Distinct improvement—(vision better) after each course, has returned to housework | February, 1931 Visual fields slight restriction of left field only now, right hemianopsia. As before, reads better. Menopause at 42. Five children |

| | | | | | | | |
|-----------------------------------|---------|--|--|--|------------------------------|---|----------------------------|
| 3954 V Adm May, 1929 | 42 ♀ | Enlargement of extremities, change in voice and appearance, impairment of vision, amenorrhea Onset, 7 years | Acromegalic features, sella turcica changes, visual fields normal, macroglossia, +15 +15 | None | 3 courses | Mild improvement; vision better, facies less acromegalic, basal metabolism still elevated | January, 1931 |
| 4460 VI Adm Feb., 1930 | 18 ♀ | Blurring of vision, menstrual irregularity Onset, 3 months | Papilledema OD 4 D OS 3 D Obesity, increased sugar tolerance, sella turcica enlarged Visual acuity 10/15 | None | 2 courses | Improved Papilledema receding OD -2 D OS -1½ D Visual acuity 20/20 Menses still irregular | March, 1931 |
| 4750 VII Adm July, 1930 | 30 ♂ | Visual impairment, polydipsia, polyuria, impotence Onset, 1 year | Pallor, dry, coarse skin, scant hirsutes, slight acromegaly, limitation of visual fields, sella turcica changes | None | 1 course | Marked improvement, vision better, disappearance of central scotoma for color, less polydipsia and polyuria, more alert, basal metabolism rose from -29 to -9 | January, 1931 |
| 3848 VIII Adm Mar., 1927 | 51 ♀ | Enlargement of extremities, visual impairment, amenorrhea Onset (1923), 6 years | Acromegalic features, optic atrophy, sella turcica changes, incomplete amaurosis, left VII n palsy | None | 3 courses | Initial improvement only, somnolence gone, mentally more alert, less irritable, vision unchanged | March, 1931 |
| 2990 IX Adm Oct., 1927 | 21 ♀ | Headache, polydipsia, polyuria, amenorrhea Onset, 5 years | Dystrophia adipogenitalis, left homonymous hemianopsia, sella turcica changes, paresis of ext. recti | Transfrontal craniotomy with partial removal of cranopharyngeal pouch cyst | 2 courses prior to operation | Not influenced by X-ray therapy | Prior to death March, 1928 |
| 4762 X Adm Sept., 1930 | 50 ♀ | Diplopia, headache, vomiting, fatigability Onset, 1½ years | Bilateral ophthalmoplegia, sella turcica changes | Exploratory craniotomy Dec., 1930 | 1 course prior to operation | Initial improvement, diplopia, headache, and vomiting disappeared, ophthalmoplegia less marked, then recurrence, operation, exitus | |
| 4059 XI Adm July, 1929 | 49 ♀ | Headache, enlargement of extremities, photophobia, polydipsia, polyuria Onset, 9 years | Acromegalic appearance, hypertrichosis, fundi negative, tongue large, neg X-ray findings | None | 2 courses | No change | November, 1930 |

Reading easier and more distinct, distant objects clearer
Three times pregnant
Patient working
Two children

Postmortem showed right hemiplegia with aphasia 4 months after operation, with exitus (no autopsy allowed)

Seven pregnancies;
menses irregular or late

TABLE ILLUSTRATING THE SALIENT FEATURES OF THIRTEEN CASES OF TUMOR
IN THE PITUITARY REGION TREATED BY RADIOTHERAPY—Continued

| Designation of subject | | Symptoms | | Findings | | Treatment | | Results | Date of last examination | Notes |
|-----------------------------------|-----|----------|---|--|------|-----------|---|---------------|--------------------------|--|
| No | Age | Sex | Operation | Radiotherapy | | | | | | |
| 2709 XII Adm May, 1927 | 56 | ♂ | Headache, visual impairment, impairment of memory Onset, 3 years | Froelich habitus, central scotoma, contraction of color fields, pallor of right optic nerve, marked sella turcica, cringes | None | 3 courses | Marked improvement (a) Disappearance of headache (b) Vision for distance and reading practically normal (c) Potency preserved (d) Memory good Persistence of bitemporal limitation for color | April, 1931 | | Patient is conducting business, 7 children |
| 1690 XIII Adm Jan., 1926 | 20 | ♂ | "Failure to grow" over period of 7 years | Genital infantilism, dwarfism, anisocoria, temporal optic neuritis, marked sella changes | None | 2 courses | No change | October, 1926 | | Patient observed for only 10 months |

the ophthalmologic signs and sella turcica changes, it was suspected clinically of being a possible tumor of the pituitary region

TECHNIC

The technic consisted of a series of nine X-ray treatments given at two- or three-day intervals, each treatment 20 to 40 per cent S E D (skin erythema dose), 860 r units¹ equal to 1 skin erythema dose. Three portals of entry were usually employed, viz, one frontal and two temporal fields. Each field received 1 skin erythema dose. The filter was 0.5 mm Cu and 1 mm Al. The voltage was 180 to 200 kilovolts. Between the series of treatments, an interval of from three to six months elapsed.

In one case (No 1) the X-ray treatment was preceded by a subsellar decompression and an intranasal surface application of radium.

RESULTS OF THERAPY

Symptoms

Headache—There was relief in three of five cases in which headache was a prominent symptom. In one instance (No 10) the recurrence of symptoms did not include headache.

Visual Disturbances—Of eleven patients complaining of impairment of vision, eight were benefited. The improvement occurred even in some of those cases in which optic atrophy, with bitemporal hemianopsia, existed. The improvement was evidenced by less marked limitation of visual fields and greater visual acuity. In some cases, the patients manifested a greater control of the oculo-motor mechanism. It may be stated that the greatest improvement occurred in those cases in which treatment was begun in the early stages of the disease.

¹This dose of 860 r units (including back scattering from the patient) represents an erythema dose. The r unit refers to the International Roentgen Unit as recently adopted by the Bureau of Standards Washington D. C.

Polydipsia and Polyuria—Three of the six patients with a diabetes insipidus syndrome showed a definite diminution in symptoms

Dyspituitarism—Berven (6) and others have expressed doubt that regression in skeletal overgrowth may occur. In Cases No 1 and No 3 regression was definitely shown by the fact that, after radiotherapy, these patients wore smaller shoes and gloves. Another patient (Case No 5) was told by her family and friends after the third course of treatment that her features did not look "so big."

Menstrual Disorder—Following treatment, there was a return of menses in three cases. In Case No 3 the return of menses persists regularly, although scantily. In Case No 2, there was a menstrual flow on two occasions, each time following a course of treatment. In Case No 6, for a time the regularity of menstrual flow approximated a return to normal but later again became irregular. In other cases of amenorrhea, the patients were either in the normal menopause years or the cessation of menses had existed for a long time.

Somnolence—In four cases there was a definitely more alert attitude noted following treatment.

VALUE OF SUCCESSIVE SERIES

It has been stated that no improvement is noted after the third series of treatments (Berven, 6). While it is true that the greatest improvement may be expected after the first or second course of deep X-ray therapy, we have been able to observe definite improvement after the third course of treatment (Cases Nos 1, 4, and 5).

DURATION OF OBSERVATION

These cases were followed over varying periods of time, from nine months (Case No 10) to six years (Cases Nos 1 and 2).

Case No 13 moved away and could not be traced.

COMMENT

Variation in technic has been stated by Béclère (2) to be the chief reason for the unsuccessful results obtained in the treatment of pituitary tumors with the roentgen ray. This may be applicable to a limited extent only, for, in our experience, variation in technic has failed in some cases to alter the unfavorable course and progressive advance of the disease (Cases Nos 9, 11, and 13). The variation in the response to treatment, we believe, is due, rather, to the type of neoplastic tissue, i.e., radiosensitivity of the tumor. Cyst formation, macroscopically evident, is the most likely reason for failure of radiotherapy in certain cases. This point is strikingly exemplified in Case No 10, in which autopsy showed a cranio-pharyngeal pouch cystic tumor, and in Case No 9, in which a similar tumor was partially removed at operation. Of interest is the fact that Case No 10 showed definite, though temporary, improvement after deep X-ray therapy.

The cardinal value of deep X-ray therapy as compared to surgical intervention lies in the beneficial results obtained in the majority of cases, with the absence of immediate mortality. This is in accordance with a critical analysis of the literature. It is not assumed that radiotherapy can entirely replace surgical interference. It is recognized that under certain conditions urgent surgical intervention is indicated, i.e., marked intracranial pressure with increasing loss of vision. In view of the foregoing, it may be stated that the patient presenting signs and symptoms of pituitary tumor should first have the benefit of a therapeutic trial with radiotherapy. Surgery may be resorted to in those cases in which this form of therapy has failed to influence the course of the disease. It may be added that radiotherapy subsequent to the operation has been found

to be a valuable therapeutic adjuvant and has been adopted as a routine procedure

CONCLUSIONS

1 Thirteen cases of pituitary tumor were subjected to roentgen-ray therapy and observed at trimonthly intervals for varying lengths of time

2 Ten of the thirteen cases were females, three were males

3 Endocrine dysfunction consisted of manifestations of hypopituitarism in eight cases and of hyperpituitarism in four cases

4 Seven of the thirteen cases were distinctly benefited by the treatment and one showed temporary improvement Amelioration of headache and improvement in vision were most frequently noted In no case was there a complete disappearance of symptoms

5 Failure to respond to treatment is highly suggestive of a cystic tumor (cranio-pharyngeal pouch cyst)

6 Patients in whom diagnosis of pituitary tumor has been made should receive therapeutic trial with roentgen therapy before proceeding to surgical intervention

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New Process of Photography by Ultra-violet Light—Photographic plates sensitive to ultra-violet light will shortly be made commercially by a new process, Dr C E K Mees has reported to the Optical Society of America

"Schumann" plates used for this purpose till now were difficult to make and had to be prepared by hand They had a coating either entirely free from gelatine or containing only a small trace of gelatine to bind the silver bromide together

In order to avoid the use of Schumann plates, two Frenchmen, Duclaux and Jeantet, suggested the treatment of ordinary plates

with a fluorescent substance which glows when exposed to ultra-violet light, and they employed petroleum oils to paint it on the plates Satisfactory results have been obtained by many workers with petroleum, but it is difficult to apply the oil uniformly and to remove it before development

R E Burroughs tested a large number of organic substances and found the most suitable to be ethyl dihydrocolhdine dicarboxylate, which fluoresces strongly in the ultra-violet This substance can be applied in organic solvents, from which it crystallizes in microscopic crystals over the surface of the plate, these crystals being easily removed before or during development of the plate—*Science Service*

AN X-RAY STUDY OF THE PASSAGE OF DIFFERENT FOOD-STUFFS THROUGH THE SMALL INTESTINE OF MAN¹

By LEON J MENVILLE, M.D., F.A.C.R., and J N ANÉ, M.D., Department of Medicine,
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THE study of the passage of various foodstuffs through the stomach and intestines had been undertaken by many investigators previous to the discovery of the roentgen ray. It was impossible at that time to visualize the viscera of experimental animals except by operation, and this was undesirable as the process of digestion was thereby interfered with. These investigators could make observations only on animals having artificial fistulas, with variable results. Cannon (1), a few years after the discovery of the roentgen ray, was the first to report observations of the passage of various foodstuffs through the gastro-intestinal tracts of healthy animals.

In recent years, marked advancement has occurred in the study of the gastro-intestinal tract, due to improved roentgen-ray technic and the use of modern powerful apparatus. For this reason, we undertook the study of the passage of carbohydrate, protein, and fatty foodstuffs through the gastro-intestinal tracts of rats and human beings, in order that the findings of the earlier investigators might be compared with the results obtained through the employment of present modern facilities.

In a recent publication (2), we reported certain X-ray observations made on the passage of carbohydrate, protein, and fat through the gastro-intestinal tracts of rats. Rats were the animals of choice for our experiments because the character of their diet is closely related to that of the human species. The rat is an animal that ideally serves this purpose, in fact, it serves better than herbivorous or graminivorous mammals.

¹Read before the Radiological Society of North America
at the Sixteenth Annual Meeting at Los Angeles Dec 1-5
1930

The results of these experiments showed that there was very little difference in the passage time of protein and carbohydrate through the small intestines of rats, although the protein moved slightly faster. Fats were much slower than either carbohydrates or proteins. The rates of emptying time of the stomach, small intestine, and colon were in accordance with the findings of other observers. The rates of passage of the different foodstuffs through the small intestine were at variance with those recorded by earlier investigators who stated that carbohydrates passed through the small intestine fastest, fats next, and proteins the slowest of all.

Experiments conducted on human beings are always desirable when practical, because the results of animal experiments, when compared to the results in man, often show marked discrepancies. In animal experiments, however, certain liberties can be taken with the use of the X-ray which would become dangerous when applied to the human, and often very valuable and important information is obtained that proves of value for subsequent experiments conducted on man.

In our reported study of the passage of different foodstuffs through the gastro-intestinal tracts of rats, certain information was obtained which would prove of great value if similar results could be procured in man. For this reason the following experiments were undertaken on humans. The observations herein reported are the results obtained from X-ray examinations of healthy normal individuals fed carbohydrates in the form of cream of wheat, protein in the form of casein, and fat in the form of pure cream. These individuals

to be a valuable therapeutic adjuvant and has been adopted as a routine procedure

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New Process of Photography by Ultra-violet Light—Photographic plates sensitive to ultra-violet light will shortly be made commercially by a new process, Dr C E K Mees has reported to the Optical Society of America

"Schumann" plates used for this purpose till now were difficult to make and had to be prepared by hand. They had a coating either entirely free from gelatine or containing only a small trace of gelatine to bind the silver bromide together

In order to avoid the use of Schumann plates, two Frenchmen, Duclaux and Jeantet, suggested the treatment of ordinary plates

with a fluorescent substance which glows when exposed to ultra-violet light, and they employed petroleum oils to paint it on the plates. Satisfactory results have been obtained by many workers with petroleum, but it is difficult to apply the oil uniformly and to remove it before development

R E Burroughs tested a large number of organic substances and found the most suitable to be ethyl dihydrocolloidine dicarboxylate, which fluoresces strongly in the ultra-violet. This substance can be applied in organic solvents, from which it crystallizes in microscopic crystals over the surface of the plate, these crystals being easily removed before or during development of the plate—*Science Service*

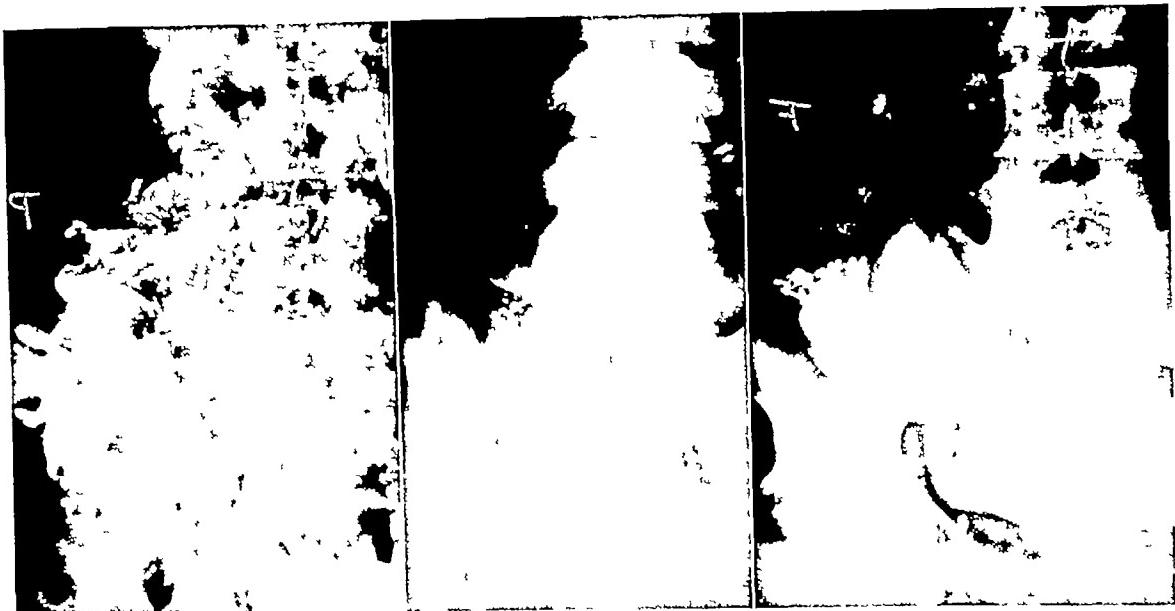


Fig 4 Cecum of case shown in Figure 1 Time, 2 hours, 18 minutes after the meal

Fig 5 Cecum of case shown in Figure 2 Time, 2 hours, 42 minutes after the meal

Fig 6 Cecum of case shown in Figure 3 Time, 3 hours, 45 minutes after the meal

TABLE I —AVERAGES
(Human)

| Foodstuff | Number | Weight | Height | Age | Ate (Grams) | Cecum appearing time | Stomach emptying time |
|--------------|--------|--------|-------------------|-----|-------------|----------------------|-----------------------|
| Protein | 6 | 154 | 5 feet, 8 inches | 30 | 170 | 2 hours, 18 minutes | 2 hours, 38 minutes |
| Carbohydrate | 5 | 162 | 5 feet, 8 inches | 30 | 176 | 2 hours, 42 minutes | 2 hours, 37 minutes |
| Fat | 6 | 164 | 5 feet, 10 inches | 30 | 170 | 3 hours, 45 minutes | 5 hours, 6 minutes |

TABLE II —AVERAGES
(Rat)

| Foodstuff | Number | Weight (Grams) | Ate (Grams) | Cecum appearing time | Stomach emptying time | Small intestine emptying time | Colon emptying time |
|--------------|--------|----------------|-------------|----------------------|-----------------------|-------------------------------|---------------------|
| Protein | 18 | 245.1 | 6.8 | 4 hours, 26 minutes | 13 hours, 9 minutes | 15 hours, 1 minute | 63.4 hours |
| Carbohydrate | 15 | 204.1 | 5.3 | 5 hours, 5 minutes | 7 hours, 5 minutes | 10 hours, 24 minutes | 53.15 hours |
| Fat | 6 | 235.8 | 5.3 | 8 hours, 35 minutes | 16 hours 44 minutes | 29 hours, 10 minutes | 61.3 hours |

tine and colon. This was considered unnecessary because our previous observations, made on the emptying time of the small intestines and colons of rats, were in accordance with those of other observers.

Table II represents our previous re-

ported results obtained in the rat experiments. In comparing the two tables we find that, in both rats and humans, the rate of passage of protein through the small intestine is fastest, carbohydrate only slightly slower, and fats decidedly slowest of all.



Fig 1 Stomach of individual fed a mixture of protein and barium sulphate in the proportion of 3 parts of protein to 1 part of barium sulphate. Film made immediately after meal³

Fig 2 Stomach of individual fed a mixture of carbohydrates and barium sulphate in the proportion of 3 parts of carbohydrates to 1 part of barium sulphate. Film made immediately after meal

Fig 3 Stomach of individual fed on fats, a mixture of cream and barium sulphate in the proportion of 3 parts of cream to 1 part of barium sulphate. Film made immediately after meal

were about of the same weight, height, and age, and were fed the same amount of food-stuffs

After being deprived of their evening and morning meals, at 9 A M we fed each group 170 gm of foodstuffs in the proportion of three parts of food to one part of barium sulphate. Immediately after feeding they were carefully fluoroscoped to ascertain if any of the food had emerged from the stomach, in every instance this had occurred. This observation is in accord with that of McClure, Reynolds and Schwartz (3). We continued our fluoroscopic observations at frequent intervals until the food column had entered the cecum.

The protein group consisted of six individuals of an average age of 30 years, average height of five feet, eight inches, and average weight of 154 pounds. They were fed a mixture of casein and barium sulphate in the proportion of three parts of casein to

one of barium sulphate. They ate 170 grams

In the carbohydrate group we had five individuals of an average age of 30 years, average height of five feet, eight inches, and an average weight of 162 pounds. This group was fed a mixture of cream of wheat and barium sulphate in the same proportion as in the protein group. They ate 176 grams.

Six individuals comprised the fat group. Their average age was 30 years, the average height five feet, ten inches, and the average weight 164 pounds. This group was given a mixture of pure cream and barium sulphate in the same proportion as in the other two groups.

Table I represents the results of observations upon the emptying time of the stomach and the cecum appearance of individuals fed different foodstuffs. As we were principally interested in the rates of passage through the small intestines of the different foodstuffs we did not continue our observation for the emptying time of the small intes-

³The observations of our experiments were obtained by fluoroscopic examination, the plates here shown (Figs 1-6) merely serving to give an idea of how the work was done.



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ported results obtained in the rat experiments. In comparing the two tables we find that, in both rats and humans, the rate of passage of protein through the small intestine is fastest, carbohydrate only slightly slower, and fats decidedly slowest of all.

CONCLUSIONS

The experiments on the human subjects demonstrate that protein—in the form of casein, carbohydrate—consisting of cream of wheat, and fat—ingested as cream, all leave the stomach at approximately the same time

The passage of protein through the small intestine of the human is much faster in every instance than fat and only slightly faster than carbohydrate. These findings in humans are similar to those obtained in our experiments with rats

We believe that the passage rate of the food column of different foodstuffs through the

small intestines of human beings is probably due to the muscular response of this organ. The rate of emptying time of the stomach seems negligible as it was demonstrated that some of the meal of the different foodstuffs passed through the pylorus at about the same time

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Radium Rays Live Only Fraction of Second—"A short and adventurous life of a hundred millionth of a second is enjoyed by an alpha ray from radium after being imprisoned in the nucleus of the atom for a period which may range from less than a year to one thousand million years" Lord Rutherford recently described in London the results of his long researches in radio-activity in these terms in a lecture before the Royal Institution. "Despite its hectic life after escaping," he continued, "the brief period of activity of the alpha particle has been so thoroughly studied that we are better acquainted with its character and adventures than we could ever hope to be with the character and personality of a distinguished citizen

"The alpha particle has played a great part in the development of physics," continued Lord Rutherford. "It provided the first evidence of the transmutation of elements. It first afforded the opportunity of detecting effects due to a single atom, thus furnishing, for the first time, definite proof of the truth of the atomic theory. By its aid, also, an early

estimate was made of the dimensions of the atom. It was, moreover, by studying the scattering of alpha particles that the nuclear structure of the atom had been revealed, a peculiarity which constituted the basis of all modern views on the nature of the atom. The alpha particle had also proved invaluable in investigating the forces reigning at the heart of the atom, and had been applied with great success to the artificial transmutation of the light elements

"The nucleus of an atom constituted a minute world of its own. If an atom of radium were magnified to the size of the lecture room, its nucleus would be smaller than a pin head. In some sense we might regard the nucleus as analogous to a drop of water which was held together by surface tension, but the analogy would be a very rough one. In the case of the nucleus, the surface tension of the water drop is replaced by a potential barrier of great height, through which the particles inside are unable to escape. The height of the barrier at its crest might be as much as 20,000,000 volts"—Science Service

PRESENT STATUS OF THE PROBLEM OF MEASUREMENT OF X-RAY INTENSITY AND QUALITY¹

By JESSE W M DuMOND, B S, M S, PH D, and ARCHER HOYT, PH D,
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OUR purpose in this paper is especially to stress the need for physically precise methods of measurement of X-radiation so as to render all clinical results accurate and mutually comparable. In our opinions, the presence of quantitative uncertainty in the biologic domain does not excuse the introduction of still more uncertainty in the physical domain, where precision is possible. In fact, physical precision is imperative in the measurement of the quality and quantity of X-rays given the patient before any progress in biologic precision can be hoped for. We wish also to point out a few of the pitfalls to be avoided in making physical measurements on X-radiation.

The physical measurements required fall into two groups, namely, measurements of *quality* and measurements of *quantity*. We shall consider first measurements of *quality*.

It is well known that X-rays form a spectrum of wave lengths. The radiation from an X-ray tube operated at, say, 200 KV constant potential is continuously distributed over a range of wave lengths from 0.061 down to, say, about 1 Ångstrom unit. The shorter the wave length, the more penetrating the radiation. If the tube is operated at a constant potential, such as can be supplied with valve tubes and condensers—or better yet with a storage battery of many cells such as the one used by William Duane in his physical researches—it is found that the radiation emitted by the tube has a sharply defined minimum wave length called the short wave limit. The tube emits no radiation harder than this limiting wave

length. Moreover, this limiting wave length is related to the constant voltage operating the tube by a very rigid physical law which states that the minimum wave length is inversely proportional to the voltage. In addition to the continuous spectrum emitted by an X-ray tube, spectral lines characteristic of the material of the target are present at certain definite wave lengths. All this is an old, well-known story.

The quality of X-radiation can be roughly described in terms of its penetrating power, or effective wave length, or depth dose, but strictly speaking it is more than any of these. In this paper, when we speak of the *quality* of X-radiation, we mean the way in which the radiant intensity is distributed over the wave length spectrum. Needless to say, the quality, or spectral distribution of radiation, is a factor of prime importance in X-ray dosage.

It has been general practice to specify quality by measuring the voltage applied to the tube, specifying the filters used. This would give a fairly dependable description, provided the voltage were supplied from a constant potential source and were measured by an accurate method. In practice, however, the source of voltage is frequently a mechanically rectified outfit which supplies a very fluctuating voltage. If the mechanical rectifier is ill designed or in poor adjustment, oscillations or surges of rather high frequency occur incident to the sparking. The peaks of these oscillations correspond to a much higher voltage than the voltage actually effective during the bulk of the time. If the voltage is measured with a sphere gap, this latter will, of course, measure the highest peak of the highest

¹Read before the Radiological Society of North America, at the Sixteenth Annual Meeting at Los Angeles Dec. 1-5, 1930.

oscillation and will, therefore, mislead the radiologist into the belief that his radiation is much harder than it actually is.

If all radiologists had mechanically rectified equipment, and if all the mechanical rectifiers were identical and in identically the same state of adjustment, the discrepancy I have just mentioned would cause no trouble. A radiologist might measure 200 KV with his sphere gap and, even if his radiation really corresponded to only about 160 KV, all other radiologists would be able to reproduce his results.

On the contrary, many hospitals and clinics now have constant potential sources of high voltage with valve tube rectifiers and condensers. Such sources are entirely free from oscillations and supply a voltage with negligible ripple. In this case a sphere gap or other measurement of voltage will give the true voltage effective in producing X-rays and not a fictitious voltage a considerable percentage higher.

Between these two extremes the discrepancy may vary as much as 40 per cent, depending on the wave form of the voltage supply. As an example, we may cite two different hospital sets which the radiologists thought in good faith were operating comparably. One spectrogram, taken on a constant potential outfit with the Seeman spectrograph, showed radiation extending in hardness down to a sharply defined minimum wave length of 0.078 Ångstrom. The voltage was computed at 157 kilovolts. The other spectrogram, taken on a mechanically rectified outfit with the same Seeman spectrograph, had an ill defined short wave limit, and only a small fraction of the radiation was harder than 0.1 Ångstrom, equivalent to 129 kilovolts. The important point, however, is that the sphere gap on this latter set broke down at a setting corresponding to 200 kilovolts. Part of this enormous discrepancy was due to the erroneous method of setting the sphere gap and then switching

on the voltage instead of first switching on the voltage and then slowly screwing the spheres together until sparking occurs. Surges incident to switching may give excessive momentary voltages. But a great part of the discrepancy is also due to the oscillations and irregular wave form of the mechanical rectifier.

The effective wave length from the constant potential set operated at 157 KV, 0.5 mm of Cu and 1 mm Al was measured with filters and found to be about 0.16 Å, while the effective wave length from the mechanically rectified set measured in the same way was about the same although its sphere gap had indicated 200 kilovolts. The effective wave length measured with filters is thus a less misleading index of the quality of the radiation though it evidently does not tell the whole story because there is a great difference in the intensity of the radiation from the two sets in the region between 0.1 and 0.07 Ångstroms.

From these and other observations we have made we conclude that it is most unsafe and uncertain to describe the quality of X-radiation merely in terms of voltage as measured with a sphere gap.

The radiologist is interested in the quality of radiation given the patient, and direct measurements of that radiation are to be preferred to indirect measurements with a sphere gap. The Seeman spectrograph in the hands of a skilled operator gives complete information as to the spectral distribution of the radiation. Depth dose measurements with a water phantom and effective wave length measurements with filters as recommended by William Duane give results that correlate well with the spectrograph.

VOLTAGE CALIBRATION WITH SPECTROGRAPH

It is possible to calibrate the voltage of a constant potential X-ray outfit very satisfactorily with the Seeman spectrograph by

making measurements of the short wave limit, because in the constant potential outfit this limit is sharply defined. We made a voltage calibration for a local hospital in this way and the departure of the individual points from the straight line was very small.

INTENSITY MEASUREMENTS

The last International Radiological Congress at Stockholm, July, 1928, has defined the roentgen unit as that "quantity of X-radiation which when the secondary electrons are fully utilized and the wall effect of the chamber is avoided produces in 1 c.c. of atmospheric air at 0°C and 76 cm mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured at saturation current."

Using the Wilson Cloud chamber method,² we photographed the tracks of the fast electrons ejected by X-rays passing through air. Three photographs were made with increasingly hard X-rays, and, the harder the radiation, the longer the tracks of the fast ejected electrons. Now small ionization chambers are used for measuring the integrated intensity of both direct and scattered radiation in the vicinity of human tissues. In such chambers an appreciable number of the electrons ejected from the air atoms in the chamber strike the walls of the chamber before they have produced their full quota of ions. This effect is greater the harder the radiation because the electron tracks are longer. The emission of fast electrons from the walls of the small chamber into the air introduces a further complication. In three of the best dosimeters now on the market which we have examined these two effects do not compensate each other for all voltages or qualities of radiation. Because of these and other facts there is good reason to believe that it is next

to impossible to build a dosimeter which will have one and the same calibration for all qualities of radiation.

We have pointed out that the quality of radiation (spectral distribution of intensity) on different types of X-ray high voltage supply is so variable that it seems infeasible for manufacturers to calibrate their dosimeters in terms precisely applicable to all sets. This means that in the present state of development of high tension generators for deep therapy the intensity measuring instrument should be calibrated at least once, and preferably periodically, against a standard ionization chamber for several voltages and filtrations *on the set with which it is actually to be used*. By the standard ionization chamber we mean a large chamber so arranged that the wall effects just mentioned are negligible. Standard chambers are suitable for calibrations of X-ray intensities only and cannot be used directly to integrate both scattered and direct radiation at a point in the vicinity of human tissues.

In the course of our work we have devised a new and simple type of dosimeter described below, which avoids many of the complications of the ionization type. With all others, however, it shares the necessity of being preferably calibrated for the set on which it is to be used.

A NEW FLUORESCENT X-RAY INTENSIMETER

About a year ago while doing some incidental work on the problem of measuring X-ray intensities we made a rather extensive analysis of the various possible methods of measurement. Searching for a simple, as well as reasonably accurate, method we set about to make use of the brilliance of the fluorescent screen as an indication of the intensity of the exciting X-ray beam. It is a matter of common experience that the brilliance of the fluorescent screen depends on the intensity of the exciting X-rays. That

²Water vapor is made to condense on the air molecules photographed.

fluorescence is a very complex physical phenomenon, having a complicated law which governs the relation of intensity to brilliance, is not necessarily a drawback to the use of this phenomenon as a means of measuring X-ray intensity, since all intensity measuring devices must be individually calibrated in terms of the international standard of intensity, roentgen units-seconds.

In using the brightness of a fluorescent screen to measure X-ray intensity, we must compare this brightness with some standard luminosity. This standard of luminosity must have about the same color as the fluorescing screen and some means must be provided to compare the standard of luminosity with the fluorescent screen excited by the X-ray beam the intensity of which is to be measured. Through the use of a device somewhat akin to the optical photometer this can be accomplished. The standard of luminosity taken is a piece of fluorescent screen (cut from the same sheet as the first screen) excited by the rays from a small quantity of radium (about 2 milligrams). It was found that the color of the fluorescent light was the same in both cases. Further, the intensity of the radiation given off by radium does not vary more than 2 per cent in 20 years, and even then varies in a known and uniform manner. Since one cannot make accurate judgments about two luminosities which differ greatly in brilliance, a neutral gray filter wedge made by the Eastman Company is used in our intensimeter to equalize the two fluorescent fields, the brilliance of the X-ray screen being cut down until it matches that of the standard, radium-excited, screen. The position of the wedge is recorded by an arbitrary scale, and calibration curves (for various voltages and filters) are made up which relate the readings on this scale to the X-ray intensity as determined initially by a standard air ionization chamber. The standard screen, which is protected by a lead

shield, is not held in the primary X-ray beam. The measuring screen is housed in a thin micarta tube which is water-proof and may be inserted into body cavities or a water phantom, if so desired. A photometric match of the two luminosities is made by viewing the two optically superimposed, concentric images of the two fluorescing screens through a Ramsden eyepiece, shifting the optical filter wedge until the central field is of the same brilliance as the outer field. This scale reading is then applied to the proper calibration curve and the intensity in r units-seconds is obtained therefrom.

This instrument possesses several special features which make it desirable in many cases. There are no electrical circuits involved with the insulation difficulties attendant upon measuring very small currents accurately. The instrument is compact, relatively inexpensive, and cannot get out of order easily. The standard of luminosity is the brilliance of a second fluorescent screen excited by radium, consequently it will not vary over a long period of time. The instrument can be used in any position and in a water phantom, further, it has no extremely delicate suspensions and fibers to be broken as do electrometers and galvanometers.

To verify the operation of our particular experimental instrument, we made a set of calibration curves for each particular filter and voltage setting used, relating the scale reading of the filter wedge to the intensity in r units-seconds. During the calibration of this instrument two independent observers agreed in the intensity measurements to within 5 per cent most of the time. This precision would be sufficient for most biologic dosage work, but by a special improvement in the optical system this precision can be somewhat improved, making the instrument quite adequate for general use.

CO-OPERATION BETWEEN PHYSICIST AND PHYSICIAN

Our experience in this locality in X-ray measurements has impressed us with the numerous pitfalls besetting the path of the roentgenologist who is anxious to be precise as to his dosage. The entire question of the physical measurements of X-ray intensity and quality is a delicate one even for a highly trained physicist. For these reasons, we feel that much could be gained by a more extensive co-operation between the physicist and the physician and we cannot too highly commend the practice of a few roentgenologists who employ the part-time services of a trained physicist to insure at all times an accurate knowledge of the radiation

given their patients. We physicists are ready to help you if physicians will call on us.

DISCUSSION

DR DUMOND (closing remarks) The instrument we have devised is not yet on the market and it is still under observation, but we feel that it has reached a sufficient stage of development to be of interest to radiologists. We have reason to believe that this instrument is not subject to the objection of deterioration of screens. However, except when the instrument is in use, we do take the precaution of removing the source of radium used as a standard from behind the screen on which it is supposed to act. We are continuing our tests on this particular feature.

Cosmic Riddle Solution Seen in Electricity on Earth and Sun—Hope that “the solution for the great cosmic riddles of the world” will be found by continued careful study of such seemingly unrelated phenomena as spots on the sun, electrified atmosphere miles above the earth, radio echoes, and electricity and magnetism in and around the earth has been expressed by Dr Arthur E Kennelly, Professor Emeritus of Electrical Engineering of Harvard University and Massachusetts Institute of Technology. His name is linked with that of the English physicist, Oliver Heaviside, in the discovery of one of the phenomena in which he thinks the solution to the great riddles lies. It is the Kennelly-Heaviside layer of ionized, or electrified, atmosphere.

“It is found from numerous records,” Dr Kennelly said, “that the apparent height of the ionized layer is related to the strength of

long-distance radio signals, such as those coming over the Atlantic ocean. Also the strength of received radio signals is found to be related to the earth’s magnetic activity, as recorded photographically in a number of terrestrial magnetic observatories. This magnetic activity, in turn, is related to the conditions at the surface of the sun as revealed by sunspots. Thus, radio reception, ionized layer height, terrestrial magnetic activity, and the 11-year sunspot cycle are all correlated. Changes in one accompany changes in the others. The spots on the surface of the sun are found to be associated with outpouring of ultra-violet light, and this may change the depth and density of the ionized layer in the atmosphere. This can affect radio signals, and somehow affects the earth’s magnetism”—*Science Service*

ROENTGEN EVIDENCE OF OSSEOUS MANIFESTATIONS IN SICKLE-CELL (DREPANOCYTIC) ANEMIA AND IN MEDITERRANEAN (ERYTHROBLASTIC) ANEMIA¹

By LEON THEODORE LEWALD, M.D., Professor of Roentgenology, New York University and Bellevue Hospital Medical College, Attending Roentgenologist Willard Parker Hospital, NEW YORK CITY

MEDITERRANEAN anemia would appear to be of unusual interest to roentgenologists because of the fact that bone changes are characteristic of the disease. There are two types which have come under my personal observation first,

Case 1 J R, male, aged 6 years, colored, presented a case of sickle-cell anemia. *The diagnosis in this case is based entirely upon the X-ray appearances of the skull.* This patient was referred to the X-ray Department at St. Luke's Hospital from the Out-

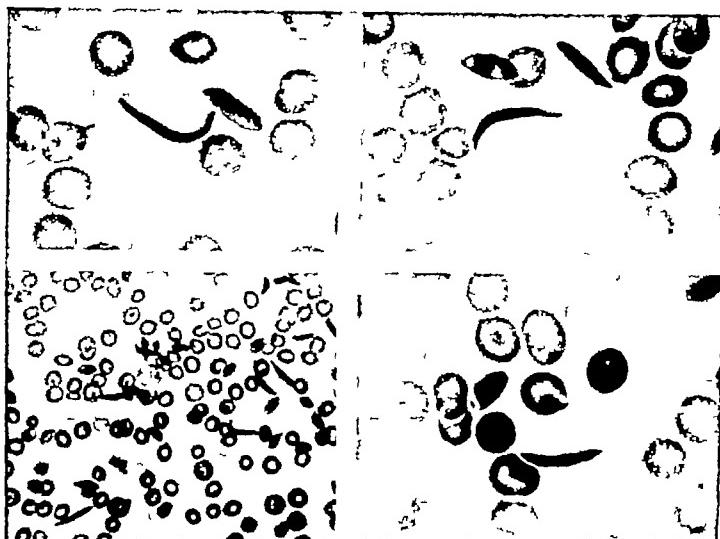


Fig 1 Blood from a case of sickle-cell anemia (Herrick)

one in which the lesion is found in the negro race (16), being commonly associated with sickle cells (5) in the blood (Fig 1), and second, the type commonly known as erythroblastic anemia (9), which occurs in races bordering on the Mediterranean, more particularly among the Italians and Greeks (2, 10). One case of the first type and two cases of the second type will be described, and comparison with similar cases reported by other authors is noted.²

patient Department for examination because of a lesion in the lower jaw

X-ray Examination—A most unusual and remarkable condition, due to the thickening of the middle and outer tables of the skull associated with peculiar radiating lines passing almost at right angles with the inner table of the skull, was revealed. The skull was approximately from one to two inches in thickness at the vertex, this thickening giving it a peculiar shape resembling that of tower skull (Figs 2 and 3). In fact, the case was regarded as belonging to this category until a paper by Rose (10), of

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.

²An additional case of Dr W. Edward Chamberlain's will be reported in a subsequent issue of RADIOLoGY.

Chicago, brought to my attention the fact that this type of skull was associated with sickle-cell anemia Dr Rose and several



Fig 2 Case 1 Colored male, age 6 years (for X-ray appearance, see Figure 3) This case is regarded as one of sickle-cell anemia from the X-ray appearance of the skull

others, who have examined skulls of this type in which the blood findings have been studied, have agreed with me that this case represents one of sickle-cell anemia, although the findings have not as yet been confirmed by blood examination, and the patient has passed out of observation I am still making efforts to trace him



Fig 3 Case 1 Since the skull shows enormous thickening, this is regarded as a case of sickle-cell anemia (See Figure 2)

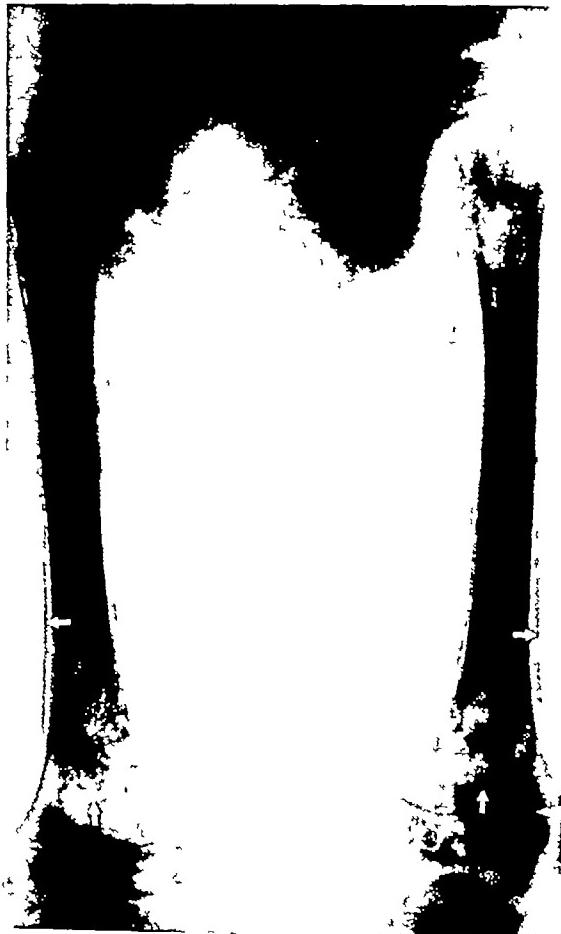


Fig 4 Chloroma in a male child, three and a half years of age Note the elevation of the periosteum in addition to the reticulated appearance of the medulla

Comment—This type of lesion has been studied particularly by Cooley, Hahn, Mandeville, Rose, Sosman, Vogt, and Wollstein In addition to the changes in the cranium, Mandeville describes irregular trabeculations in the pelvis, vertebræ, ribs, clavicles, and scapulæ He also describes thinning of the cortex of the long bones, stating that this is an important rather constant finding, and rarefaction of the shafts of the long bones, sometimes referred to as "transparent medulla"

In distinction to the bone changes observed in chloroma, I would call attention to the fact that there are no periosteal changes in sickle-cell anemia, while, in chloroma (3),

periosteal changes, in addition to medullary changes, constitute an important radiologic appearance (Fig. 4) In chloroma there is also a characteristic separation of the suture lines of the skull along with productive

female (reported as Case 3) are said to have anemia

Blood Examination (April 30, 1930)—Hemoglobin, 36 per cent, erythrocytes, 3,670,000, leukocytes, 13,000 The cor-



Fig 5 Same case as shown in Figure 4 Note the separation of the sutures

changes in other portions, such as about the orbits and temporal regions rather than the vertex (Fig. 5) The changes are easily distinguished from those seen in rickets, scurvy, and syphilis

Case 2 N D, male, aged 14 years was born in New York of Italian parents, the mother coming from southern Italy This case (Fig. 6) is one of Mediterranean anemia of the congenital type associated with enlargement of the spleen (erythroblastic anemia) The patient had been under observation six years previously on account of enlarged spleen He had been given X-ray treatment which resulted in marked reduction of the size of the spleen and apparent improvement in his general condition Three cousins, two males and one

puscles showed marked anisocytosis and poikilocytosis with a few sickle-shaped forms, many normoblasts, and an occasional megaloblast There were pronounced central pallor, basophilic stippling, and polychromatophilia. The differential leukocyte count showed polymorphonuclear neutrophils, 48 per cent, small lymphocytes, 45 per cent, large mononuclear leukocytes, 3 per cent, eosinophils 3 per cent, and basophils, 1 per cent

After treatment, the blood examination showed hemoglobin, 48 per cent, erythrocytes 4,180,000, leukocytes, 8,000 Characteristics of erythrocytes the corpuscles showed anisocytosis and poikilocytosis with marked central pallor some polychromatophilia and basophilic stippling An oc-

casional normoblast was seen. The differential leukocyte count showed polymorphonuclear neutrophils, 49 per cent, small

striations and thinning of the cortex of the long bones reported by other observers in this type of anemia (Fig. 7) were seen

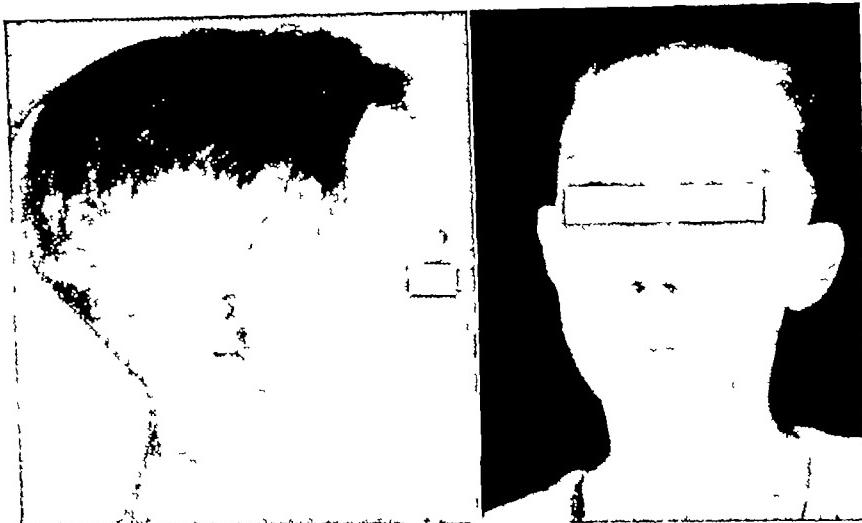


Fig. 6 Case 2 Mediterranean anemia (erythroblastic type). Note the mongoloid features



Fig. 7 Case 2 (A) Note the striated appearance of the medulla and thinning of the cortex (B) Normal shown for comparison

lymphocytes, 42 per cent, large mononuclear leukocytes, 4 per cent, eosinophils, 5 per cent, basophils, none

X-ray Examination—The characteristic

The skull showed a peculiar thickening in the frontal and in the occipital region (Fig. 8). In the frontal region the bone was about one-half inch in thickness, in the oc-



Fig. 8. Case 2. Note the thickening of the skull with radiating lines over the vertex. The sphenoid sinuses are undeveloped.

cipital, the skull was about three-quarters of an inch thick. The sella turcica was rather small. The sphenoid and left frontal sinuses were undeveloped, and the maxillary sinuses were very small.

Comment.—This case is of particular interest in view of the fact that, whereas splenectomy has been advised in this type of anemia, the same result seems to have been accomplished by means of X-ray therapy. The patient's spleen has remained reduced

in size after an interval of several years after X-ray treatment ceased.

The changes in the skull in this type of anemia offer considerable contrast to the changes found in sickle-cell anemia. The thickening of the skull is more uniform and appears to be localized to the frontal and occipitoparietal regions, rather than to the vertex. There is less evidence of striations than in sickle-cell anemia. The changes in the medulla of the long bones are particularly evident, especially when contrasted with the normal subject on the same film.

Case 3. I.D., female, aged 11 years, born in New York of parents from Southern Italy, is a cousin of Case 2 (Fig. 9). The diagnosis was Mediterranean anemia, congenital in nature (erythroblastic anemia).

X-ray Examination.—The skull showed the typical thickening characteristic of erythroblastic anemia. The thickening was particularly evident in the middle and outer tables in the frontal region where the skull measures three-quarters of an inch in thickness. The parietal region also showed thickening amounting to about one-half inch.

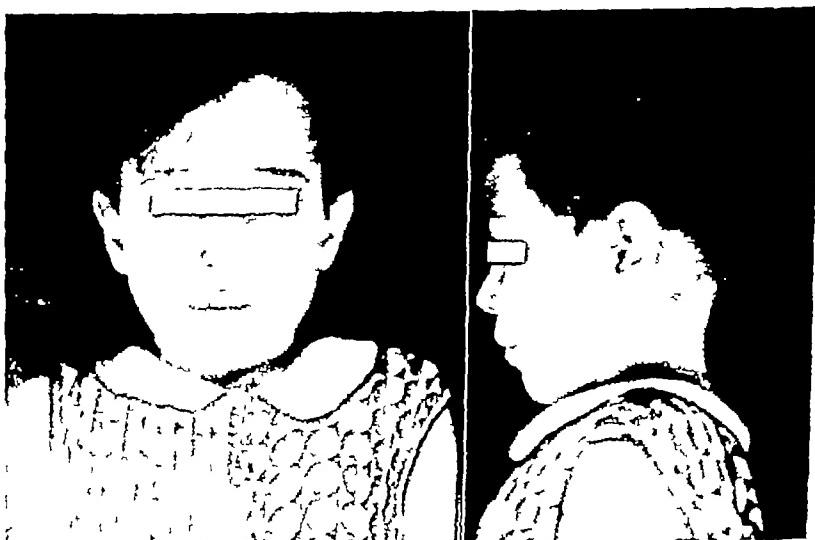


Fig. 9. Case 3. Mediterranean anemia (erythroblastic type). This child is a cousin of the patient known as Case 2.

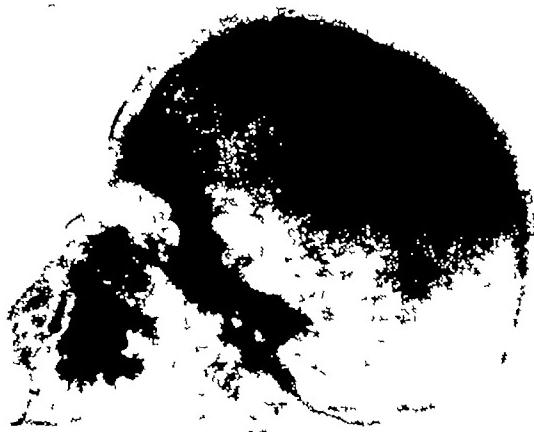


Fig 10 Case 3 Note the thickening of the skull, with radiating lines over the vertex

(Fig 10) There was fairly well marked striation at right-angles to the inner table of the skull in the thickened area in the frontal region. The sphenoid sinuses were undeveloped. The sella turcica was of average size. In the long bones examined, the cortex was thinned and the medulla striated. Similar changes were noted in the small bones of the hand, being particularly evident in the metacarpal bones of the thumb (Fig 11)

Comment—This case is of particular interest in view of its familial type, showing its congenital nature

CONCLUSIONS

1 Mediterranean anemia shows characteristic changes in the bones of the skull and other portions of the skeleton

2 In the negro, the disease manifests itself as sickle-cell anemia, being characterized by involvement of the vertex of the skull, which shows at times enormous thickening in the form of radiating lines at right-angles to the inner table of the skull

3 Erythroblastic anemia occurs in white children of Mediterranean parentage, especially in Italians and Greeks. The roentgen findings show characteristic changes in the skull consisting of thicken-

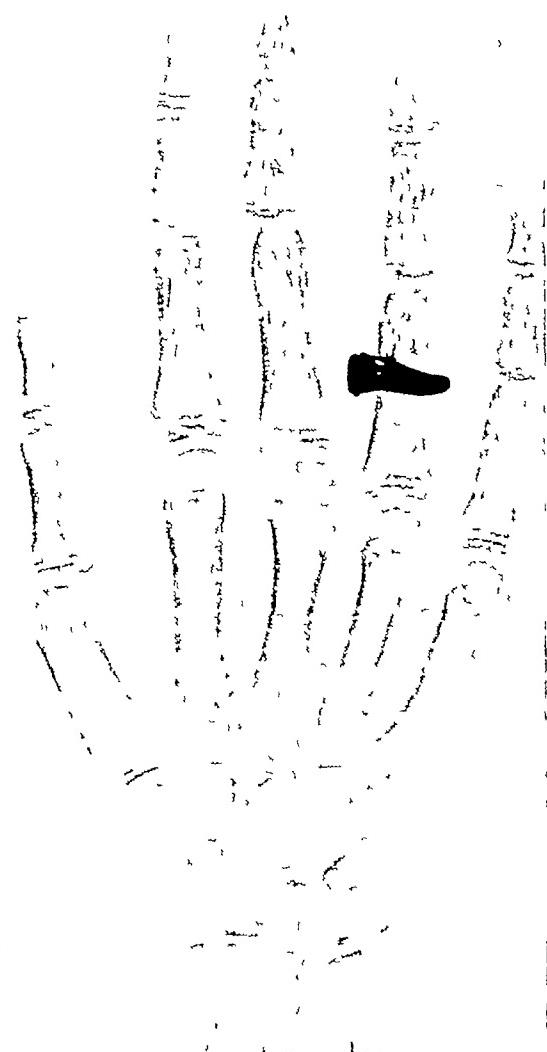


Fig 11 Case 3 Note the striated appearance of the medulla and thinning of the cortex

ing, especially in the frontal and occipitoparietal regions

4 In erythroblastic anemia associated with enlargement of the spleen and liver, roentgenotherapy is an exceedingly valuable method of treatment and may give as satisfactory and permanent a result as splenectomy

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Lists Eight Forerunners of Cancer of Digestive Tract—Eight conditions of injury or degeneration which occur in the digestive tract before the development of cancer have been listed by Prof Matthew J Stewart, of the University of Leeds, in a series of lectures delivered before the Royal College of Physicians

"At the present time it is probably true to say that the most hopeful side of cancer research is that concerned with the demonstration of local causative factors, and the recognition and prevention of precancerous lesions of one kind or another," Prof Stewart declared at the beginning of his first lecture

"Unfortunately it is to the more superficial forms of malignant disease, a very small fraction of the whole, that this principally applies"

Conditions of the digestive tract that may develop into cancer are not so definitely known as precancerous conditions elsewhere in the

body, Prof Stewart pointed out, nor are the opportunities so good for preventing cancer of the digestive tract

In one year there were 56,896 deaths from cancer in England and Wales, according to the official figures he quoted. Of these, over half in men and nearly half in women were referable to the digestive tract

Prof Stewart divided the chief precancerous conditions into three groups. The first consisted of chronic inflammatory conditions, such as sores due to burns and chemical caustics, cirrhosis of the liver, certain diseased conditions of the gall bladder, chronic stomach ulcer, chronic inflammation of the stomach, chronic duodenal ulcer, and three conditions less well-known to the layman, diverticulitis hemochromatosis, and leukoplakia. The second group consisted of simple tumors which may be forerunners of cancer. The third group consisted of sores or injuries due to animal parasites.—*Science Service*

THE PRESENT STATUS OF APPENDICEAL DIAGNOSIS¹

By ROY A PAYNE, M.D., PORTLAND, OREGON

THE papers on appendiceal pathology, in 1886, and the reports of the first operation for the removal of the appendix, in 1887, had far-reaching effects. The spectacular results in a certain percentage of the cases led to operations for acute or chronic appendix for a wide range of abdominal symptomatology, either real or imagined. The inevitable reaction followed and the pendulum swung far back until operation for any except acute appendices was condemned. The diagnosis of chronic appendicitis was disputed by many surgeons. There must be a calm or a cyclone—no gentle breeze was tolerated.

My work in diagnosis began at a time when, of patients entering the clinic in which I worked, nearly 50 per cent had previously had their appendices removed. At least one-half of these had received no admitted benefit from the operation. Routine X-ray examinations of 6-hour and immediate meal, 24-hour, 48-hour and enema, revealed few appendices outlining. Naturally we accepted the prevalent view and in those early years I remember only two diagnoses of appendicitis being made.

Yet from time to time reports filtered back of patients who had suffered removal of ruptured appendices at later dates. Re-checking of our records revealed no sure criterion for a diagnosis. Upon seeking the opinions of others on this subject which was of tremendous interest to us, we found a wide variation of opinion among roentgenologists. I well remember a discussion in which I was interested to hear one roentgenologist maintain that all appendices which did not outline were pathologic and should come out. His opponent was equally

certain that any appendix that did outline was pathologic and should come out. We decided that more work was necessary before the subject could be closed.

Our efforts to obtain evidence redoubled. More careful and more frequent screenings of the emptying cecum revealed filling in the majority of appendices. Careful palpation discovered tenderness often appearing at a screening although it had been absent on previous exposure. In some cases this pain was referred to the region of the solar plexus and the patient compared it to digestive discomforts that had been complained of in his history. At about this time A. L. Gray, M.D., of Richmond, Virginia, reading in Washington, D.C., on "Cyclic Vomiting in Children," traced the etiology to the appendix. He stated his belief that children showing an appendix with an emptying time of over 100 hours had a pathologic appendix. In cases in which the appendix was removed, the patients were relieved of the vomiting.

Rejoicing that this work in children coincided with our studies of adults, we continued our investigation. In checking the literature we found a gradually increasing number of articles on this subject. The reason for this is well set forth by Gatewood (3), who states:

Despite the enormous literature on appendicitis, the recent statistical reports show an increasing mortality. The reasons for this are not at once apparent but, in looking over new cases, we have been struck by the fact that mortality occurs chiefly at the two extremes of life. The seriousness of appendicitis in children has been well recognized, but there has not been so much observed about appendicitis in the aged. Moes, discussing the subject at the Louisiana Medical Society, gave a mor-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1-5, 1930.

tality of 29 per cent in patients over 50 years of age E M Fitch, in 1928, reported the results of a questionnaire covering 6,548 cases The average mortality rates in institutions replying to his queries averaged from 19 to 9 per cent In patients over 50 years of age, the death rate averaged from 19 to 50 per cent

In his series at the Claremont, North Hampshire, Hospital the mortality was 21 6 per cent in patients between 50 and 60 and 54 per cent in patients between 60 and 70 Part of the high mortality is attributed to the lowered resistance of the patients Much more however, can be explained upon the basis of errors in diagnosis and upon pathology peculiar to these older individuals Lehman reported six cases from the Virsorginshien, in Lains, calling attention to this atypical picture, and Erdheim, in his pathologic conferences at the same institution, has frequently demonstrated autopsy specimens of old persons dying of unrecognized appendicitis with resultant peritonitis

I wish to present an analysis of findings in 256 cases, taken from a series of 4,500 case records in private practice, in which appendiceal pathology has been demonstrated Our observations of the appendix are listed under (1) Abnormality in position, (2) Tenderness, (3) Stasis, (4) Non-filling, (5) Abnormal outlines and adhesions While this research has been developed independently, we make no claim to originality in this matter Bird (1), 1928, stated and illustrated beautifully the majority of these points He says

In following up a number of cases in which I had reported what I believed to be a pathologic appendix, and in which the surgeon had agreed with the diagnosis and performed an appendectomy, a correlation of the findings has led me to consider that an appendix having any of the following characteristics is probably pathologic

(1) Retrocecal and bound down by adhesions

- (2) Adhesions holding the tip in a fixed position
- (3) The presence of sharp kinks or loops that are constant and cannot be smoothed out under the fluoroscope
- (4) A constriction of the lumen at the base, with a bulbous tip
- (5) Pressure tenderness over the appendix, changing with change in position of the cecum
- (6) Retention of barium in the appendix after the cecum is empty

It is to amplify this and to study further relationships that we undertook our inquiry

Let us review the causes of the first of these conditions Accidents to the cecum naturally affect the appendix and, conversely, accidents to the appendix may affect not only the appendix but the position and the function of the cecum Whether the pathology present in these instances is the result of early inflammations or mere accidents of growth is open to question Certainly the demonstration of the altered position is most important to the patient, as, knowing it, any physician who sees the patient during an acute attack may much more easily obtain a diagnosis in the presence of atypical symptomatology, and the surgeon at operation may incise to fit the altered anatomy Relationships to other organs are much altered Altered positions must result in changed lymphatic drainage In our experience gallbladder and duodenal pathology seem much more frequent in these cases

Again, in the matter of stasis, anatomic conditions are involved Andresen (2) states

Several anatomic facts in regard to the appendix must be borne in mind to understand its physiologic and pathologic behavior In the normal appendix, the mucosa is ciliated, with the action of the cilia directed towards its outlet, its muscular coat is fashioned for contraction in the same direction and the valve of Gerlach at its outlet acts to prevent regurgitation of cecal contents into the appendix It is,

therefore, evident that the appendix is supposed to empty itself of its contents, but is not supposed to be invaded by the contents of the cecum. It also seems reasonable to suppose that contractions of the cecum, induced by the entrance of material from the ileum, play a part in stimulating the appendicular contractions.

A considerable ileal residue twenty-four hours after a barium meal, when not due to a prolonged gastric retention, is indicative of some pathology in the ileocecal region and further study of the ileum at one-hour intervals following the barium meal may show that this pathology is a narrowing, dilatation, or deformity of the ileum due to kinks or inflammations so frequently associated with appendix adhesions.

In attempting to get some reasonable basis upon which to interpret this factor of stasis in the appendix, we have followed the cases in some instances for as long as 32 days and have observed the relationship of stasis to pathologic findings at the time of operation. We are inclined to think that if Gray had continued his observations he would at present possibly lower somewhat his 100-hour limit for normal appendices in children. From our observations we would feel that, in the adult, an appendix which remains filled over this time should be considered as pathologic. When we think of the absorption factors in this narrow-lumened organ, it is evident that any fecal material remaining in here for that period must necessarily bring about the possibility of an inflammatory reaction. Particularly is this true when we consider that the cecum is probably the site of the most virulent bacteria growth of any part of the bowel.

Of the cases 197, or 77 per cent, show tenderness, 136, or 53 per cent, show stasis of from 100 to 700 hours. Next to tenderness this is the most frequent finding. In all, 65 cases, or 25 per cent of the total, were found in an abnormal position. This is enough to indicate the opportunities for not

visualizing except by most persistent and painstaking study.

We were ourselves somewhat startled to find no cases in this list which we were able to diagnose as appendiceal pathology when there was absence of filling. To us this emphasizes the fact that a very great percentage of appendices will fill at some time if closely watched.

The grouping together of adherent appendices and abnormal outlines seems fitting to us. This group will include enteroliths, narrowed lumen, sharp, fixed angulations, and dilatations. The appearance of these in 35 cases, or 13 per cent, is rather understating the frequency of these findings.

We have records of operative procedure in 30 cases, or 11 per cent. Doubtless numbers of others have undergone surgery. Even if double this number, it would but emphasize that these findings are essentially medical in the majority of cases.

Of related diagnostic points many are briefly discussed. The most important of these is the presence of 157 cases of colon stasis. The relationship of constipation to appendiceal tenderness is so clearly evident that in those cases in which tenderness is present without colon stasis we are much more inclined to advise immediate surgery.

Gall-bladder pathology was present in 61, or 24 per cent of the cases, duodenal pathology (ulcer, persistent spasm, banding), in 52, or 20 per cent, and stomach pathology in 9, or 3 per cent. The frequently related pathology in the old triumvirate of appendix, gall bladder, and duodenum seems well borne out.

Though we find many appendices without gall-bladder or duodenal pathology, it is indeed seldom that we find the latter two present without evidences in the appendix of old, if not present, trouble. We believe it is in this right lower quadrant that the majority of the trouble with the gall bladder, at least, has its start.

Colitis diagnosed in 10 cases, or 4 per cent, is perhaps leaning backward. So strong is our impression that these irritations of the colon mucosa are frequently secondary to periodic passing of irritating bacteria from the gall bladder or appendix that we diagnose colitis only when anatomic changes show the walls and mucosa so altered that pathology is self-sustaining there, independent of the original source of infection.

Dental sepsis was present in 44 cases, or 17 per cent. Tonsil (nose and throat) sepsis was present in 105, or 41 per cent. This last seems of particular moment to us. The resemblance between the adenoid tissue in the tonsil and that of the appendix has been frequently marked. The frequency with which appendiceal flare-up, often of most serious character, follows a cold and tonsillitis, is striking.

Pelvic pathology was diagnosed in 38, or 15 per cent. Not only does trouble in this quarter cause conflicting diagnoses but frequently the varying blood supply in pelvic pathology actually incites appendiceal irritations.

We note nervous and mental complications in 8 cases, or 3 per cent, thyroid abnormality in 32, or 13 per cent, and lung pathology of varying degrees in 73, or 29 per cent. Of more direct interest here is the appearance of ileac regurgitation in 26, or 10 per cent. In a considerable percentage of cases this is due to distortion of the ileocecal valve by inflammatory adhesions. Evidence of bands about the cecum or ileum is present in 76 cases, or 30 per cent.

Pathology of the urinary tract appeared in 34 cases, or 13 per cent. We are convinced that more careful study over large numbers of cases will demonstrate relationship between appendiceal pathology and pus conditions in the kidney pelvis. We have seen one case, which required frequent irrigations of the kidney pelvis, while carrying an appendix with a 300-hour stasis, live

for two years without serious kidney trouble after an appendectomy.

Blood changes occurred in 20 cases, cardiospasm in 1, arthritis in 11, and cardiovascular affections in 14 cases.

Changes in blood sugar occurred in 12 cases. This is of interest in the light of the discussion by surgeons and clinicians of the value of removal of the gall bladder in diabetic cases. Our impression is that the gall bladder should be removed, when possible, in the presence of definite sepsis, as is the tonsil. But we do feel that before this is done the appendix should be evaluated roentgenologically and removed at operation if the X-ray examination shows pathology, no matter what its appearance is to the surgeon.

Skin complications in 2 per cent of the cases are small numerically, but the relationship between appendiceal stasis and acne vulgaris should have widespread study. In some cases the factor causing skin sensitivity to low-grade infection may be, as in at least two of my cases, related to prolonged appendiceal stasis.

We agree fully that tenderness is the most important sign to be elicited in a study of an appendix. But when Lahey (4) says, "X-ray evidence as to the possible presence of chronic or recurrent appendicitis is limited in our opinion to tenderness directly over the appendix by fluoroscopy," he is speaking for the surgical appendix.

It is full time for surgeons and internists to realize that there is appendiceal pathology which is subject to medical treatment. Bowel regulation alone will help many. Often as we study these cases we wonder how much relief in the colon stasis cases has been from coincident relief of appendiceal symptoms. Relief from associated sepsis will aid and in a considerable percentage of cases, avoid acute inflammatory reactions.

The evidence obtainable can be of greatest value in determining expediency of opera-

ANALYSIS OF 256 CASES WITH DIAGNOSIS OF APPENDICEAL PATHOLOGY

1—Appendiceal Findings

| Number of cases | Abnormal position | Tender-ness | Stasis | Non-filling | Adhesions and abnormal outlines | Surgery |
|-----------------|-----------------------|------------------------|------------------------|-------------|---------------------------------|---|
| 256 | 65, or 25 per cent | 197, or 77 per cent | 136, or 53 per cent | 0 | 35, or 13 per cent | 30 and 2 post-operative, or 11 per cent |

2—Associated Diagnosis

| Colon stasis | Gall bladder | Pathology involving duodenum | Pathology involving stomach | Colitis | Septic teeth | Nose and throat sepsis | Pelvic pathology |
|------------------------|-----------------------|------------------------------|-----------------------------|-----------------------|-----------------------------|------------------------|-------------------------|
| 157, or 61 per cent | 61, or 24 per cent | 52, or 20 per cent | 9, or 3 per cent | 10, or 4 per cent | 44, or 17 per cent | 105, or 41 per cent | 38, or 15 per cent |
| Nervous and mental | | Thyroid pathology | Lung | Ileac regurgitation | Bands about cecum and ileum | | Urinary tract pathology |
| 8, or 3 per cent | | 32, or 13 per cent | 73, or 29 per cent | 26, or 10 per cent | 76, or 30 per cent | | 34, or 13 per cent |
| Neuritis | Blood | Diverticulum | Cardio-vascular | Arthritis | Blood sugar abnormalities | Skin | |
| 0 | 20, or 7 per cent | 4, or 1 per cent | 14, or 6 per cent | 11, or 4 per cent | 12, or 3 per cent | 7, or 2 per cent | |

tion when other factors are present. For instance, the question of surgery or medical treatment, and the best method of approach in surgery, may well be affected in a tubal infection when appendiceal pathology is present roentgenologically. Double surgery may often be avoided if this study is made. Listed abnormalities in the position of the appendix clarify questionable symptomatology and alter the optimum site for surgical approach. Careful study and record of pathologic appendices will be of tremendous value in determining the etiology of some obscure disease complications.

Frankly, appendiceal pathology is too important to be buried under the opprobrium attached to the term "chronic appendicitis." Roentgenologists alone can evaluate the condition of the organ. Let them select the term to apply to the finding so that the internist will understand there is need of care in the line of his efforts. Let it be a term that the surgeon can hear without reaching for his surgical kit.

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DISCUSSION

DR. LEWALD (New York). There are two things in particular I wish to speak of. One is the length of time that opaque material may be observed in the appendix. Dr. Payne called attention to one case of 300 hours—I have one case of about 3,000 hours. The second point bears directly on retention and if that long-retaining appendix would necessarily have had to be removed. That appendix I cite has not been removed. The patient has given more attention to the bowels, and the attacks she had had previously have not recurred, so far as I can find out, in over two years.

There are two extreme displacements of the

appendix that were not mentioned by Dr Payne, but they are very pertinent

A very short time ago, a surgeon operated in the usual way on a child of about 10 years of age for supposed appendicitis. No X-ray examination had been made and it was found on operation that there was no appendix in the usual location. The surgeon naturally surmised that there was an appendix somewhere in the abdomen, enlarged his incision, and brought it out from the *left* side. I made an X-ray examination of the child afterwards and found a complete *transposition of the viscera*. But the little girl who did not need to have her appendix out at all now has a scar.

I asked her about her symptoms when I saw her later. So far as I could figure out, she had what we ordinarily speak of as "congestion of the spleen" or a "stitch in the side," in her case her spleen being on the *right* side. I asked her if she had this trouble any more and she said, "Yes, when I run, I feel the same old pain on my right side." So I presume this bears out the fact that it was her spleen and not the appendix.

The other type of lesion is the *non-rotation of the colon* which brings the appendix to the left side. I saw one case operated on for a supposed duodenal ulcer or adhesions to the gall bladder in which a series of films were made of the upper right side of the abdomen alone, but in that particular case the appendix was on the left side and very low down. The surgeon, after exploring thought he would

reach down and see if he could find the appendix, but he could not, and so he had to close up *without* removing the appendix. There were no adhesions about the duodenum. I mention this because, there being no transverse colon and no complete U-shaped duodenum, the duodenum runs a peculiar course—it does not loop down, but shoots straight out to the right, looking as if it were fixed by adhesions to the gall bladder.

DR PAYNE (closing) During the meal, we sometimes find that an appendix which has not filled before will fill when the opaque enema is taken. We usually screen those cases 48 hours after the enema. As a rule I find it is better, when we have been working with an appendix of this kind, to terminate the work with a plate. Oftentimes the image is so faint that one is unable to pick it up with the fluorescent screen, and so I think it is safer to plate the right lower quadrant and check up for the position of the appendix in this way.

We list segmentation simply under the abnormal appearance and barium stasis, being prone to judge the importance of this finding by its associated symptomatology.

Dr LeWald has surpassed us on the length of his emptying time. As I stated, we watched one boy's appendix for thirty days and his appendix was still filled at the end of that time. We advised operation, but the patient put it off. A month or so later, the condition flared up in the middle of the night, demanding emergency surgery.

HEREDITY OF CANCER¹

By MME. N DOBROVOLSKAYA-ZAVADSKAYA, M.D., PARIS

IT is rather difficult to speak on the heredity of cancer in this country, where such a great deal of work concerning this subject has been done. But the problem is so complex and so important that, I believe, any new material is of interest.

Our research on cancer heredity was started in 1927, by establishing a few isolated strains of mice, descending each from a cancerous mother. We are endeavoring, of course, to eliminate all possible causes of cancer, except heredity, to keep the mice as clean as possible, and to create for them conditions as hygienic as can be attained with animals.

Professor Borrel, in France, insists, as you know, on cancer in mice being produced by a small worm (*filaria*) *Muspicea borreli*, which he found in his stock and which he supposes to be a conveyer of an invisible virus, a real cancerogenic agent.

In order to find out whether or not our cancerous mice carry this filaria, we examined 40 of our cancerous stock (among them were two normals taken for control), following exactly the method of cleavage of Professor Borrel, and found this worm in only five cases, that is, in 13.2 per cent of all cancerous animals examined. It means that about 87 per cent of our stock develop their tumors without any influence of that parasite, whereas Professor Borrel reports them to be present in his stock in from 80 to 90 per cent of all cancerous mice. The difference between our results and those of Professor Borrel is probably to be explained by the greater attention we pay to the hygienic conditions of our stock.

Small nodules in the mammary glands, supposed by Professor Borrel to be due to ir-

ritation produced by *Muspicea*, are rather characteristic of adenocarcinomatous condition in general. In the cases of sarcomas, nodules were not found in the mammary glands, even in the presence of *Muspicea*.

Our breeding experiments are far from being concluded, but two strains of mice presenting a striking difference are nearly ready and their preliminary results may be reported now.

Strain No 5 (Chart II) was originated by a female having an ordinary adenocarcinoma of the breast and was continued by inbreeding until the third generation. The general result of this strain may be summed up as follows: out of 125 males, six developed epithelial tumors of a glandular type, and five developed sarcomas. Out of 114 females, 66 developed epitheliomas—in which there were 64 adenocarcinomas of the breast—and six developed sarcomas.

Strain No 4 (Chart I) was originated by a female having a very rare tumor, reproducing in the most typical points the structure of hair follicles and known under the name of Borrel-Haaland's tumor. This female, fecundated by an unknown male, gave birth to a litter of three females which developed cancer, and two males, one of which developed a sarcoma. The whole second generation was produced by three cancerous sisters mated to one sarcomatous brother, the reproduction being stopped with the third generation.

On the whole, this strain consisted of 242 animals. Out of 125 males, five developed sarcomas, and two, epitheliomas. Out of 117 females, 16 developed sarcomas, and eight, epitheliomas, among which were only three mammary adenocarcinomas.

If all kinds of cancers were controlled by

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles Dec. 1-5, 1930.

appendix that were not mentioned by Dr Payne, but they are very pertinent

A very short time ago, a surgeon operated in the usual way on a child of about 10 years of age for supposed appendicitis. No X-ray examination had been made and it was found on operation that there was no appendix in the usual location. The surgeon naturally surmised that there was an appendix somewhere in the abdomen, enlarged his incision, and brought it out from the *left* side. I made an X-ray examination of the child afterwards and found a complete *transposition of the viscera*. But the little girl who did not need to have her appendix out at all now has a scar.

I asked her about her symptoms when I saw her later. So far as I could figure out, she had what we ordinarily speak of as "congestion of the spleen" or a "stitch in the side," in her case her spleen being on the *right* side. I asked her if she had this trouble any more and she said, "Yes, when I run, I feel the same old pain on my right side." So I presume this bears out the fact that it was her spleen and not the appendix.

The other type of lesion is the *non-rotation of the colon* which brings the appendix to the left side. I saw one case operated on for a supposed duodenal ulcer or adhesions to the gall bladder in which a series of films were made of the upper right side of the abdomen alone, but in that particular case the appendix was on the left side and very low down. The surgeon, after exploring thought he would

reach down and see if he could find the appendix, but he could not, and so he had to close up *without* removing the appendix. There were no adhesions about the duodenum. I mention this because, there being no transverse colon and no complete U-shaped duodenum, the duodenum runs a peculiar course—it does not loop down, but shoots straight out to the right, looking as if it were fixed by adhesions to the gall bladder.

DR PAYNE (closing). During the meal, we sometimes find that an appendix which has not filled before will fill when the opaque enema is taken. We usually screen those cases 48 hours after the enema. As a rule I find it is better, when we have been working with an appendix of this kind, to terminate the work with a plate. Oftentimes the image is so faint that one is unable to pick it up with the fluorescent screen, and so I think it is safer to plate the right lower quadrant and check up for the position of the appendix in this way.

We list segmentation simply under the abnormal appearance and barium stasis, being prone to judge the importance of this finding by its associated symptomatology.

Dr LeWald has surpassed us on the length of his emptying time. As I stated, we watched one boy's appendix for thirty days and his appendix was still filled at the end of that time. We advised operation, but the patient put it off. A month or so later, the condition flared up in the middle of the night, demanding emergency surgery.

There seems to be in the human body some antagonism of one for the other. We know that the average age of a case of carcinoma is about 48 years and that of sarcoma is about 28 years, and that most of the cases of sarcoma, about 34 per cent, occur between the ages of 11 and twenty.

I would like to know if, in any of these animals, the two diseases occurred in the same animal?

DR. J. E. GENDREAU (Montreal) I would like to ask Dr. Zavadskaja if the conditions under which she bred mice were the same as those used by Maud Slye, if the presence or absence of secondary factors in producing the cancers could explain a difference in the results, and if these secondary factors were very important in the production of cancer?

DR. LEON MENVILLE (New Orleans) The question of cancer heredity is a subject of great importance. Dr. Zavadskaja has exemplified the possibilities of heredity in the production of cancer. The work of Dr. Smith, of the Department of Agriculture in Washington, is also quite interesting. By the use of certain bacilli, Dr. Smith has produced tumors in the vegetable kingdom, particularly in the beet and castor plant, analogous to cancer tumors. The injection of this bacilli will produce the parent tumor with metastasis in other parts of the plant. The microscopic section of these tumors is similar to the malignant tumors in the human. Therefore, it would seem somewhat convincing that the micro-organism theory could play a part in the production of cancer. The heredity theory is also convincing, especially after listening to such an eminent authority as Dr. Zavadskaja.

DR. H. J. ULLMANN (Santa Barbara, Calif.) After reading it, one will have to think this paper over for some time to appreciate the problems involved and the possibilities of the findings.

In evaluating any such reaction as has been described, one must compare the evidence and the data presented with a formula or equation which must be integrated in which all the fac-

tors are variables. Doctor Zavadskaja had demonstrated the selective action, and one can, therefore, say that the type of cell is one of the factors that is a variable. Let me suggest another variable—the metabolism as a whole, and perhaps, also, the metabolism or type of cells surrounding the tumor being treated. We must, also, take into consideration the time intensity of the irradiation, another variable, and perhaps, in addition, the wave length of the irradiation. I have felt for some time that the wave length might be a factor to be considered in spite of Arndt-Schulz's well accepted law.

Regaud has shown that, the shorter the wave length, the more selective the action of the irradiation. Moffatt, in the *Medical Journal of Australia*, April 11, 1930, presented a very interesting piece of work. He showed the varying effects of different wave lengths on the egg membrane of eight-day chick embryos. He found complete atrophy at 0.11 Ångstrom, 0.53 and 0.79. The effect was sharply restricted to these wave lengths, the greatest atrophy being found at 0.11 and the least at 0.79. An extensive myxomatous change occurred at 0.16 Ångstrom, apparently it was a characteristic response to that wave length. Hypertrophic nodules occurred, this effect being most pronounced at 0.63 Ångstrom. A leukocytosis had its chief effect at 0.32 and again at 0.34 Ångstrom. Epithelial stimulation was most definite in this reaction. Some stimulation in all was found, but the peak was at 0.16 Ångstrom and again at 0.89, where it was enormous. At this point it was almost like a carcinomatous growth. At 0.84 Ångstrom, the epithelium was invaded by leukocytes. The atrophy was so sharply confined to certain wave lengths that Moffatt feels that other effects than the electron effect must occur. As 0.11 Ångstrom was so much shorter than the characteristic radiation of any element present, he suggests that the effect is on an inner electron and relatively close to the nucleus.

Of course, in most of the tests so far made, portions of the spectrum relatively close together have been used, and, in looking for

the same gene as a simple mendelian character, recessive to normal condition, such a combination as given in this strain (three cancerous sisters mated to a sarcomatous brother) should produce only cancerous descendants. In reality, the numbers obtained are too small for cancer, being of a simple mendelian character, either dominant or recessive. A premature mortality cannot explain this deficit because there were many animals which lived sufficiently long and died without cancer. The only assumption which can account for the results of Strain No 4 is that there are different genes for sarcoma and for epithelioma, both recessive to normal condition.

Some other peculiar conditions as angiomas, angiomatous cysts of the ovaries, a kind of rodent ulcer, cystic kidneys, etc., were observed in the same strain.

Since the majority of these conditions are generally not considered as malignant tumors, and as their relation to cancer, especially from a genetic standpoint, is not yet quite clear, the full interpretation of the results of this strain is not yet possible. But there is a point which is quite evident, that is, a profound difference exists between the two strains (Charts I, II). This difference becomes apparent if we consider the most common tumor in mice, *i.e.*, cancer of the breast. There are 64 mammary adenocarcinomas in 114 females of Strain No 5, and only three such tumors in the 117 females of Strain No 4. This difference cannot be explained by any external conditions, because these were exactly the same for both strains and in some instances the animals even lived together in common cages. The causes of this difference may be sought only in intrinsic conditions most probably hereditary and primarily, in the histologic structure of two initial tumors one was an ordinary mammary adenocarcinoma, and the other a very rare tumor of a special structure, reminding one of the hair follicles.

The observations just reported, incomplete as they are, seem to allow the following preliminary conclusions:

1. There is evidence in favor of a hereditary factor in the origin of cancer and, perhaps, neoplastic diseases in general.

2. The different histologic types of tumors are probably dependent on different genes in germ plasm.

3. All kinds of irritations, chronic inflammation, etc., contribute to the development of cancer in predisposed organisms and determine its localization.

CHART I—STRAIN NO 4, TUMOR BORREL-HAALAND

| | Normal | Sarcoma | Epithelioma | Totals and tumors (per cent) |
|---------|--------|---------|-------------|------------------------------|
| Males | 118 | 5 | 2 | 125 = 5.6% |
| Females | 93 | 16 | 5 + 3 | 117 = 20.5% |
| Totals | 211 | 21 | 10 | 242 = 12.8% |

CHART II—STRAIN NO 5, ADENOCARCINOMA OF THE BREAST

| | Normal | Sarcoma | Epithelioma | Totals and tumors (per cent) |
|---------|--------|---------|-------------|------------------------------|
| Males | 114 | 5 | 6 | 125 = 9.6% |
| Females | 42 | 6 | 2 + 64 | 114 = 63.2% |
| Totals | 156 | 11 | 72 | 239 = 34.7% |

DISCUSSION

DR. EMIL G BECK (Berkeley, Calif.) Has the Doctor ever observed that carcinoma and sarcoma co-existed in the same animal? In the human being this is very rare, there are only a few cases reported in the literature. I have never seen a case myself, and I have asked a good many of my confreres but they cannot remember that such a case has occurred in their practice.

We know that sarcoma affects principally the young and carcinoma the elder people.

MEDICO-LEGAL DEPARTMENT

CONTRIBUTIONS¹ BY I S TROSTLER, MD., CHICAGO

UNNECESSARY ROENTGENOSCOPY NOT REQUIRED

(United States Fidelity & Guaranty Co
et al vs Wickline (Neb.),
170 N W R 193)

The Supreme Court of Nebraska holds that a claimant for compensation under the employers' liability act pursuant to Section 3675 of the Revised Statutes of Nebraska of 1913, cannot be denied a recovery because of a refusal to submit to a roentgen-ray examination or to have a roentgenogram taken of the person, where the uncontradicted evidence shows that neither was necessary. Section 3675 provides that, after an employee has given notice of an injury he shall, if so requested by the employer or the insurance company carrying such risk, submit himself to an examination by a physician or surgeon furnished and paid for by the employer or the insurance company, and refusal of the employee to submit to such examination shall deprive him of the right to compensation during the continuance of such refusal. The court says that under the statute the request for an examination must be reasonable, and it did not appear to have been in this case. The testimony before the court showed affirmatively that neither a roentgen-ray examination nor a roentgenogram was necessary. No physician nor other person testified that either was necessary, nor did it appear that a request was made to the court to require the employee to submit to either. In the present advanced state of the science of roentgen-ray examinations and the taking of roentgenograms of the person there appears to be no reason why such examination or roentgenogram should not be permitted by a claimant for compensation under the employers' liability

act, on request by the employer or insurer, unless the request is shown to be unreasonable.

BARS TESTIMONY AS TO WHAT ROENTGEN- GRAMS SHOW

(Lang *vs Marshalltown Light, Power & Railway Co (Iowa)*, 170 N W R 463)

The Supreme Court of Iowa holds that there was no error in a ruling in this personal injury case sustaining objection to questions such as one asking a physician to state whether or not a certain roentgenogram did, or did not, show a curvature of the spine, as appeared in the negative. The Court says that the defendant cited a number of cases to the proposition that roentgen-ray negatives and photographs, properly verified, are admissible in evidence, and this proposition was not disputed by the plaintiff. Cases were also cited by the defendant, holding that it is proper for experts to interpret and explain roentgen-ray plates to the jury. Among these was the case of *State vs Matheson*, 142 Iowa, 414, 120 N W 1036. It was claimed, too, that some of the cases hold that a witness may testify as to what the photograph shows. But the court thinks that the questions asked in this case, and the ruling thereon, were within the ruling of *Elzig vs Bales*, 135 Iowa, 208, 112 N W 540, wherein it was said, in effect, that, as demonstrative evidence, roentgenograms serve to explain or illustrate and apply the testimony, and are aids to the jury in comprehending the questions in dispute. When taken for either purpose they are the best evidence of what appears on them. The rule exacting the best evidence applies to the testimony of experts, as well as to that of other witnesses, and it was error to permit a physician to testify to what appeared in a roentgenogram.

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the selective effects of different wave lengths, we must compare very short and very long wave portions of the spectrum I believe that the wave length effect must be taken into consideration in at least certain parts of our work

DR. ZAVADSKAIA (closing) In replying to Dr Beck's question, if there is coincidence of both tumors, sarcoma and epithelioma, I might say there is, but very rarely in mice

Sarcoma in humans is a malignancy of the young, in mice it is rather a tumor of old age, even older than adenocarcinoma of the breast, because adenocarcinoma was generally developed between six and eighteen months, and sarcoma was mostly developed at two years of age and even later (once, at two years and eight months) Therefore, you see, the tumor age is different in different species If we admit that there are two different genes for sarcoma and epithelioma, the coincidence of both of them in one animal is probably very rare

To reply to Dr Gendreau's question about the rôle of external conditions Miss Maud Slye and I try to put our animals in the best possible conditions to eliminate all causes of cancer but heredity But there may be some kind of parasite which escapes us, and this is one of our next problems to study It is very probable that other causes, an irritation, for instance, may develop cancer only in predis-

posed animals The demodec, very common on the skin of man, is very rarely the real cause of cancer All this calls for further research

I know Dr Smith's experiments, but I know, also, other facts, for instance, the experiments in plants, of Dr Kostoff He obtained real tumors in the Nicotiana hybrids by crossing different species which, as pure lines, never developed a tumor He examined these tumors and did not find any microbe there It is probable that microbes play a part in certain plant cancers But you cannot easily transfer the results obtained in plants to animals, even in mice, sarcoma and epithelioma behaved differently, as you have seen it, and probably we have to deal with many different kinds of cancer

Tumors in hybrids are now being studied by Dr Reed and Dr Gordin in the Zoological Department of Cornell University They have found tumors in hybrids of small Mexican fish I do not remember the name of this fish, but when I visited them they showed me these animals Hybrids developed a very malignant pigmented tumor, a kind of nevo-sarcoma which kills the animals

So you see how complex is the problem and there are different approaches to the study of it Perhaps these tumors in hybrids are also indications that the hereditary factor plays an important part in the development of cancer

Urge X-ray Diagnosis of Children's Teeth
—Full X-ray examination of the mouths and teeth of young children has been urged by Dr Leo J Schoeny, of New Orleans before the American Dental Association

"Recent developments in X-ray apparatus render it possible to make such examinations even upon very small and nervous children," he said "Such examination will enable the

dentist to discover dental defects and disorders at an early age and to prevent their further development and more serious consequences, such as malocclusion, pyorrhea, and dental caries By means of the X-ray diagnosis on small children, the dentist shall be in a position to contribute his full share toward preventive dentistry and medicine"—*Science Service*

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based on the information divulged by these plates. The expert who made the plates did not testify, nor did any one who was present at the time the plates were made. The Court said that the plates were not admissible in evidence, nor could they be, until they were properly identified or shown to have been made by trustworthy instruments properly used by a person skilled in making, reading, and interpreting such plates, and further shown to be correct representations of the bony structure of the plaintiff's head. The admission of roentgenographic plates in evidence rests fundamentally on the theory that they are the pictorial communication of a qualified witness who uses this method of conveying to the jury a reproduction of the object of which he is testifying, this being true, the roentgenographic plates must be made a part of the testimony of some qualified witness, and the witness should qualify himself by showing that the process is known to himself to give correct representations, and that it is a true representation of such object.

RULE AS TO PRIVILEGED COMMUNICATIONS
IS APPLIED TO ROENTGENOLOGIST

(Shaw *vs* City of Nampa (Idaho), 171
Pac R 1132)

The Supreme Court of Idaho applies the

rule as to privileged communications to a roentgenologist, in this personal injury case, under the following circumstances, as stated by the Court. When the plaintiff was injured, she employed a physician who immediately took her to another town, where he employed a physician to take a roentgen-ray picture of her broken arm. After the picture was taken and developed, the second physician or roentgenologist consulted with the first or plaintiff's regular physician relative to the interpretation of the picture and the treatment to be administered. Counsel for the plaintiff objected to the roentgenologist's testifying as to any facts learned while he was thus employed, which objection the Supreme Court holds was properly sustained. It appeared from the evidence, the Court goes on to say, that the roentgenologist did more than perform mere mechanical work as a photographer, and that he used his knowledge and experience as a physician in interpreting the meaning of the picture, and advised with the plaintiff's regular physician as to what treatment should be given, the plaintiff paying the roentgenologist for his services. The trial court was justified in excluding such evidence as privileged communication, under the Revised Codes of Idaho, Section 5958, Paragraph 4.

PHYSICIAN PREPARING TO GIVE EXPERT
TESTIMONY MAY PROPERLY STIPULATE
FOR COMPENSATION

(*Birch vs Sees (N Y)*, 165 N Y
Supp 846)

The Supreme Court of New York Appellate Division, Second Department, said that it must take it as established by the verdict for \$500 rendered in favor of the plaintiff that he, an attending physician and a life-long acquaintance of the deceased whose will had been offered for probate, having testified on a prior trial as an expert witness for the proponent of the will, at an agreed compensation of \$50 per day, was thereafter employed by a succeeding attorney for the proponent at the same terms, to go over the witness' records to prepare himself so as to give expert testimony on the issue of the deceased's mental soundness, which he did on two trials, there having been three trials. It was, however, objected that as the plaintiff had been the attending physician his testimony was not that of an expert, and that such agreement for compensation should not be enforced. But it seems settled that if a medical witness, or other witness with technical qualifications, goes beyond mere testimony to facts, observed by the senses, and is asked to draw a technical inference or conclusion, he may properly stipulate for compensation. The facts in this case were therefore within the permissive rule, and the judgment on the verdict for the plaintiff, should be affirmed with costs.

PURPOSE FOR WHICH ROENTGENOGRAMS
MAY BE USED

(*Russell vs Borden's Condensed Milk Co of Utah (Utah)*, 174 Pac R. 633)

The Supreme Court of Utah says that in this personal injury case it was contended that the trial court erred in admitting in evidence certain roentgenograms showing the condition of the plaintiff's hip and hip joint.

It was insisted that the roentgenograms had a tendency to mislead the jurors, who were merely laymen and thus possessed no knowledge respecting the injuries to the bone or to the hip or hip joint. If the roentgenograms had been introduced for the purpose indicated by counsel, there would be much force to their contention. A jury of laymen possessing no knowledge or experience respecting the bones and injuries thereto might easily be misled by a mere roentgenogram, by which at the best merely the outline of the bone can be shown. The roentgenograms, however, were not introduced for the purpose indicated by counsel. They were used by the physicians in illustrating their evidence, and were fully explained, and were introduced in evidence only as affording a fuller and clearer understanding by the jury of the physicians' testimony respecting the condition of the plaintiff's injured hip and hip joint. The court committed no error in receiving the roentgenograms for the purpose for which they were received and used.

UNIDENTIFIED ROENTGENOGRAMS NOT

ADMISSIBLE AS EVIDENCE

(*Bartlesville Zinc Co vs Fisher (Okla.)*,
159 Pac R 476)

The Supreme Court of Oklahoma reverses a judgment obtained by Plaintiff Fisher, for personal injuries, on account of error in the admission in evidence of certain roentgenographic plates tending to prove the existence of certain physical defects in and about the bony structure of his head. The evidence afforded to identify the plates was given by a physician who testified that from an examination of the plaintiff, based on symptoms related to him, he was unable to find the cause of the plaintiff's trouble, and sent him to another physician to have a roentgenographic plate made, and that he was not present when the plates were made. The witness further testified that his evidence, relative to the plaintiff's injuries was

Valve V_1 , a magnetic valve which closes the passage from A to B , consists simply of a small cylindrical piece of soft iron loosely sealed in a glass plunger which is ground with fine emery to make a good joint at one end. The solenoid furnishes a magnetic field

vents any air from accidentally entering A which would cause the loss of the collected emanation. D is a regulator which automatically increases the amount of heat supplied to H when the pressure in E and H is increased.

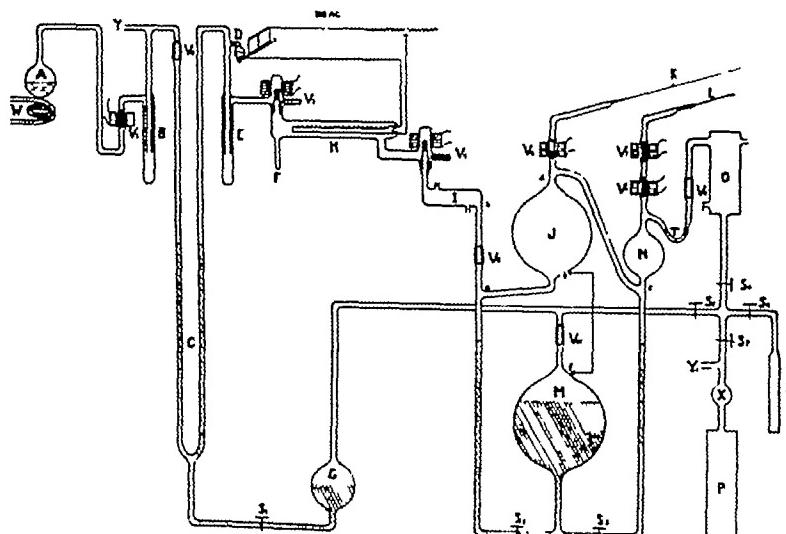


Fig. 1 Diagram of emanation plant

for lifting the plunger when an electric switch is closed. B and E are traps used to collect vapors when they are submersed in a mixture of solid CO_2 and acetone.[†] Y is the tube which connects the duplicate sides of the apparatus. The apparatus is made in duplicate in case one side becomes broken or out of order. V_2 is an emergency valve to prevent any possibility of mercury getting into or beyond B . G is a mercury reservoir into which the mercury is drawn to open the passage from B to E . The mercury is always kept at a height of about 40 cm in C except when the passage is being opened, so that, in case any part of the apparatus becomes accidentally broken, the mercury will rise to a difference in height of approximately 76 cm and stop. This pre-

V_3 is a magnetically operated, mercury-sealed valve which when closed prevents vapors from migrating from E into F or H . The opening in V_3 must be fairly large to allow a free circulation of gases and vapors from E to F and H . This valve is shown in detail in Figure 3 in which B' is a glass plunger which is ground to form a tight joint at A' . The joint is surrounded with mercury to form a mercury seal when B' is lowered into the mercury. D' is a glass plunger containing a small cylinder of soft iron. When it is desired to open the valve for a long period of time, B' is raised and the plunger D' is moved under it with a permanent magnet. The valve will withstand atmospheric pressure in the direction of the arrows E' to F' . In the opposite direction it will withstand only a low pressure.

F is a small tube containing a few crystals

[†]The freezing point of acetone is below that of CO_2 which permits a better thermal contact with the glass trap than of the trap.

CASE REPORTS AND NEW DEVICES

AN APPARATUS FOR COLLECTING RADIUM EMANATION

By ALEXANDER J ALLEN and
RACHEL G FRANKLIN

Cancer Research Laboratories, University of
Pennsylvania Graduate School of Medicine,
PHILADELPHIA

INTRODUCTION

Radium emanation has a definite place in the treatment of cancer. Its chief advantage over the radium element is that it can be put into small enough containers and is of such nature that, once inserted into a tumor, it need never be removed. A second advantage is that while radon can be used for every treatment for which the radium element can be used, radon implants contain no radium. If they are mislaid, carried away on a patient, or lost in any other way, the loss is negligible. However, good radium emanation plants are of necessity sufficiently complicated to make them costly to install and to maintain. By the adoption of modern scientific methods it was hoped to develop a plant of low initial and maintenance costs which would be practical for both small and large amounts of radium.

The requisites of a good emanation plant are

1 The apparatus must be efficient, that is, as much as possible of the emanation formed must be collected in the container in which it is to be used, and it must be well purified, as it is usually desirable to use the emanation in as small a container as possible.

2 The apparatus must be reliable and as fool-proof as possible, that is, it must be sturdy and practically free from breakdown.

3 It is desirable to have it as simple as possible to maintain and operate.

4 The problem of safety to the operator must be considered.

5 Any saving in cost is always desirable.

With the above points in mind, a constant effort has been made to simplify and improve the apparatus described in the article published last year(1). The necessity of using P_2O_5 has been eliminated by the use of solid CO_2^* and the plant is of such design that any water which is taken from the radium solution is again returned. Once the plant is installed it is not necessary to renew or replace any parts, except the gold and glass implant tubing.

The apparatus is made entirely of Pyrex glass, which makes it more sturdy and less liable to break down than if it were made of soft glass. Mercury diffusion pumps simplify the usual pumping procedure and produce excellent vacua with a minimum amount of labor. Magnetic valves simplify the design and operation of the apparatus. The time that an attendant must be in the vicinity of the apparatus is small, which reduces the danger of over-exposure to gamma rays.

DESCRIPTION OF PARTS

In the diagram of this plant (Fig 1), *A* indicates a glass bulb which is enclosed in a safe and contains the radium solution. This is surrounded by a copper coil, *W*, through which water is circulated to keep the temperature of the radium solution below that of the outside room temperature.

*Through the courtesy of the Sharpless Ice Cream Company we have been furnished free of charge with all the solid carbon dioxide necessary to develop and operate our plant.

Valve V_1 , a magnetic valve which closes the passage from A to B , consists simply of a small cylindrical piece of soft iron loosely sealed in a glass plunger which is ground with fine emery to make a good joint at one end. The solenoid furnishes a magnetic field

vents any air from accidentally entering *A* which would cause the loss of the collected emanation. *D* is a regulator which automatically increases the amount of heat supplied to *H* when the pressure in *E* and *H* is increased.

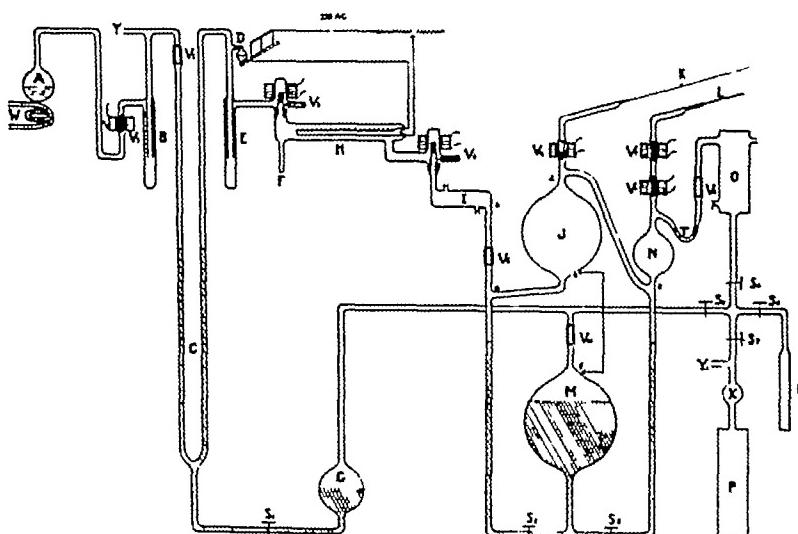


Fig 1 Diagram of emanation plant

for lifting the plunger when an electric switch is closed B and E are traps used to collect vapors when they are submersed in a mixture of solid CO_2 and acetone \dagger Y is the tube which connects the duplicate sides of the apparatus. The apparatus is made in duplicate in case one side becomes broken or out of order V_2 is an emergency valve to prevent any possibility of mercury getting into or beyond B . G is a mercury reservoir into which the mercury is drawn to open the passage from B to E . The mercury is always kept at a height of about 40 cm in C except when the passage is being opened, so that, in case any part of the apparatus becomes accidentally broken, the mercury will rise to a difference in height of approximately 76 cm and stop. This pre-

V_3 is a magnetically operated, mercury-sealed valve which when closed prevents vapors from migrating from E into F or H . The opening in V_3 must be fairly large to allow a free circulation of gases and vapors from E to F and H . This valve is shown in detail in Figure 3 in which B' is a glass plunger which is ground to form a tight joint at A' . The joint is surrounded with mercury to form a mercury seal when B' is lowered into the mercury. D' is a glass plunger containing a small cylinder of soft iron. When it is desired to open the valve for a long period of time, B' is raised and the plunger D' is moved under it with a permanent magnet. The valve will withstand atmospheric pressure in the direction of the arrows E' to F' . In the opposite direction it will withstand only a low pressure.

The freezing point of acetone is below that of CO which permits a better thermal contact with the glass trap than does the CO₂ alone and hence greatly increases the efficiency of the trap.

F is a small tube containing a few crystals

CASE REPORTS AND NEW DEVICES

AN APPARATUS FOR COLLECTING RADIUM EMANATION

By ALEXANDER J ALLEN and
RACHEL G FRANKLIN

Cancer Research Laboratories, University of
Pennsylvania Graduate School of Medicine,
PHILADELPHIA

INTRODUCTION

Radium emanation has a definite place in the treatment of cancer. Its chief advantage over the radium element is that it can be put into small enough containers and is of such nature that, once inserted into a tumor, it need never be removed. A second advantage is that while radon can be used for every treatment for which the radium element can be used, radon implants contain no radium. If they are mislaid, carried away on a patient, or lost in any other way, the loss is negligible. However, good radium emanation plants are of necessity sufficiently complicated to make them costly to install and to maintain. By the adoption of modern scientific methods it was hoped to develop a plant of low initial and maintenance costs which would be practical for both small and large amounts of radium.

The requisites of a good emanation plant are:

1 The apparatus must be efficient, that is, as much as possible of the emanation formed must be collected in the container in which it is to be used, and it must be well purified, as it is usually desirable to use the emanation in as small a container as possible.

2 The apparatus must be reliable and as fool-proof as possible, that is, it must be sturdy and practically free from breakdown.

3 It is desirable to have it as simple as possible to maintain and operate.

4 The problem of safety to the operator must be considered.

5 Any saving in cost is always desirable.

With the above points in mind, a constant effort has been made to simplify and improve the apparatus described in the article published last year(1). The necessity of using P_2O_5 has been eliminated by the use of solid CO_2^* and the plant is of such design that any water which is taken from the radium solution is again returned. Once the plant is installed it is not necessary to renew or replace any parts, except the gold and glass implant tubing.

The apparatus is made entirely of Pyrex glass, which makes it more sturdy and less liable to break down than if it were made of soft glass. Mercury diffusion pumps simplify the usual pumping procedure and produce excellent vacua with a minimum amount of labor. Magnetic valves simplify the design and operation of the apparatus. The time that an attendant must be in the vicinity of the apparatus is small, which reduces the danger of over-exposure to gamma rays.

DESCRIPTION OF PARTS

In the diagram of this plant (Fig 1), *A* indicates a glass bulb which is enclosed in a safe and contains the radium solution. This is surrounded by a copper coil, *W*, through which water is circulated to keep the temperature of the radium solution below that of the outside room temperature.

*Through the courtesy of the Sharpless Ice Cream Company we have been furnished free of charge with all the cold carbon dioxide necessary to develop and operate our plant.

radon is forced when glass implants are wanted. The radon is transferred into the small gold tube, L , which is waxed on to the glass when gold implants are wanted.

V_6 , V_7 , and V_8 are magnetic valves sim-

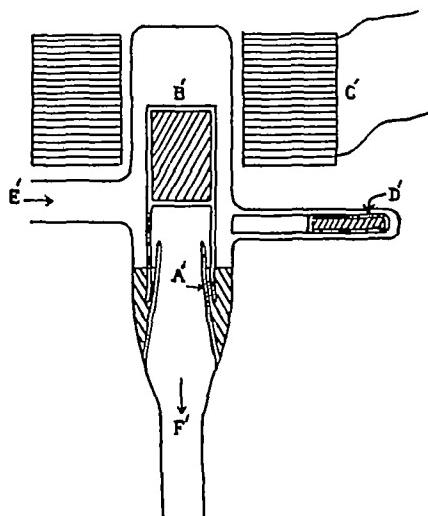


Fig. 3 Detailed diagram of special magnetic valve

ilar to V_1 . T is a trap which when filled with mercury prevents radon from entering O and prevents air from entering N . V_9 is similar to V_5 and V_2 and prevents mercury from flowing into O . O is an ordinary glass mercury vapor diffusion pump which aids in quickly and easily obtaining an excellent vacuum throughout the system. P is a Mega Vac oil pump which produces sufficient vacuum for the operation of O and also for the withdrawal of the mercury from C , J , and N . S_4 , S_5 , S_6 , and S_7 are ordinary glass stop-cocks which control the inlet or exit of air to the various parts of the system. S_1 , S_2 , and S_3 are mercury-sealed stop-cocks (2) which control the flow of mercury in and out of C , J , and N , respectively. V_{10} is the same as V_2 , acting as an emergency check valve which prevents the mercury from flowing past it in case of accident. X is a trap which prevents mercury or foreign material from entering the oil pump P . Q is a CaCl_2 dryer and glass wool air filter.

A photograph of this plant is shown as Figure 2.

PROCESS OF WITHDRAWING RADON

Assuming the apparatus to be completely evacuated and the mercury and valves in positions as indicated in Figure 1, the procedure for withdrawing, purifying, and collecting the radon into the gold or glass tubes is as follows: immerse trap E into a Dewar flask containing solid carbon dioxide and acetone. Valve V_4 remaining closed, open valve V_8 . Lower the mercury in C for about 20 seconds or longer, depending on the total amount of gases collected in A , by applying a vacuum to G , thus opening a passage from A to E . The fact that E is nearly -40°C will cause a rush of water vapor from A which condenses in E and carries with it most of the radon, hydrogen, oxygen, carbon dioxide, helium, etc. \ddagger . The water vapor is thus trapped in E , and the hydrogen and oxygen pass on to the hot copper screen in H and are reduced to water vapor. The CO_2 is taken up in F . After standing three or four minutes C is again opened for a few seconds and practically all the remaining radon is drawn into the purification chambers. The apparatus is then allowed to stand about 25 minutes, during which time the radon becomes well purified. Before V_4 is opened, it is necessary to close the trap T and the passage from J to N . This is done by admitting air pressure to M and opening cock S_3 , thus allowing the mercury to rise in N .

V_4 is then opened and the mercury diffusion pump I quickly (approximately one minute) forces the purified radon from the purification chambers into J . S_2 is then opened, which allows the mercury to rise in

\ddagger At -40°C the vapor pressures of the enclosed vapors are water, 0.096 mm., radon, 200 cm., hydrogen, very high, oxygen, very high, CO_2 , 76 cm., approximately. Since the vapor pressure of water is very low, it condenses and remains in the trap while the other gases or vapors present are free to migrate about the purification chambers.

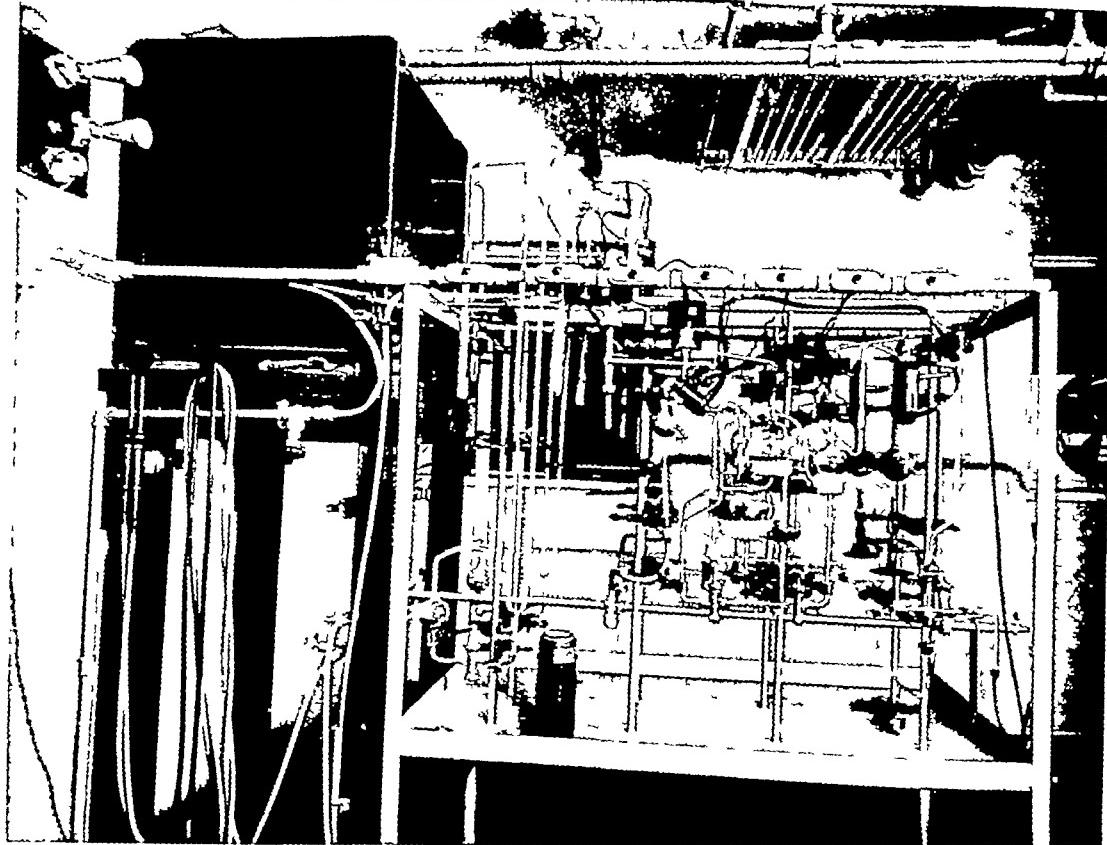


Fig 2. Photograph of emanation plant. Such an apparatus has been placed by the Cancer Research Fund in the Oncologic Hospital in Philadelphia, where it is in regular and successful use with 200 mg of radium.

of potassium hydroxide. This removes small traces of CO_2 , which is apparently generated by the disintegration of small amounts of organic matter which could not be removed from the apparatus. This seems necessary, to obtain radon of high concentration, especially when the apparatus is first put into operation. If it were not for the presence of the CO_2 , valve V_3 and tube F could be eliminated. H is a platinum wire which is placed in or around a quartz tube and heated with an electric current. This supplies heat to an oxidized copper gauze surrounding the quartz tube which causes hydrogen and oxygen to recombine to form water vapor. Hydrogen and oxygen are produced by the disintegration of water in A by the presence

of the α , β , and γ radiations from the radium and its disintegration products.

V_4 is a valve similar to V_3 , except that it can be much smaller. Its use is to prevent the radon from entering I until it has become well purified. I is a small mercury diffusion pump which is used to force the purified radon from D , E , F , and H into J . This pump works very satisfactorily and very quickly. V_5 is a glass check valve which automatically prevents mercury from flowing from M into I . J , N , and M are simple Toppler pumps used to force the radon into K or L . For convenience in making the diagram, reservoir M is shown lower than it is in reality. Actually, c and f are at the same level. K is the small glass capillary into which the

radon is forced when glass implants are wanted. The radon is transferred into the small gold tube, L , which is waxed on to the glass when gold implants are wanted.

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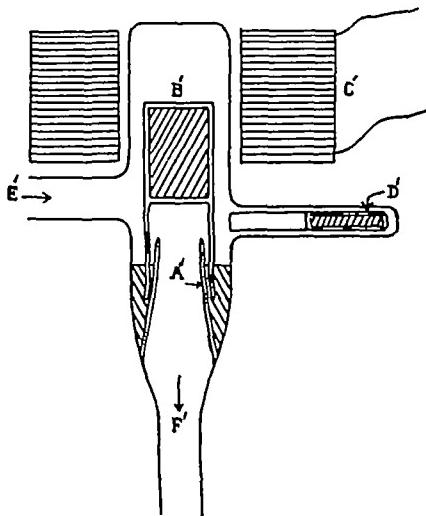


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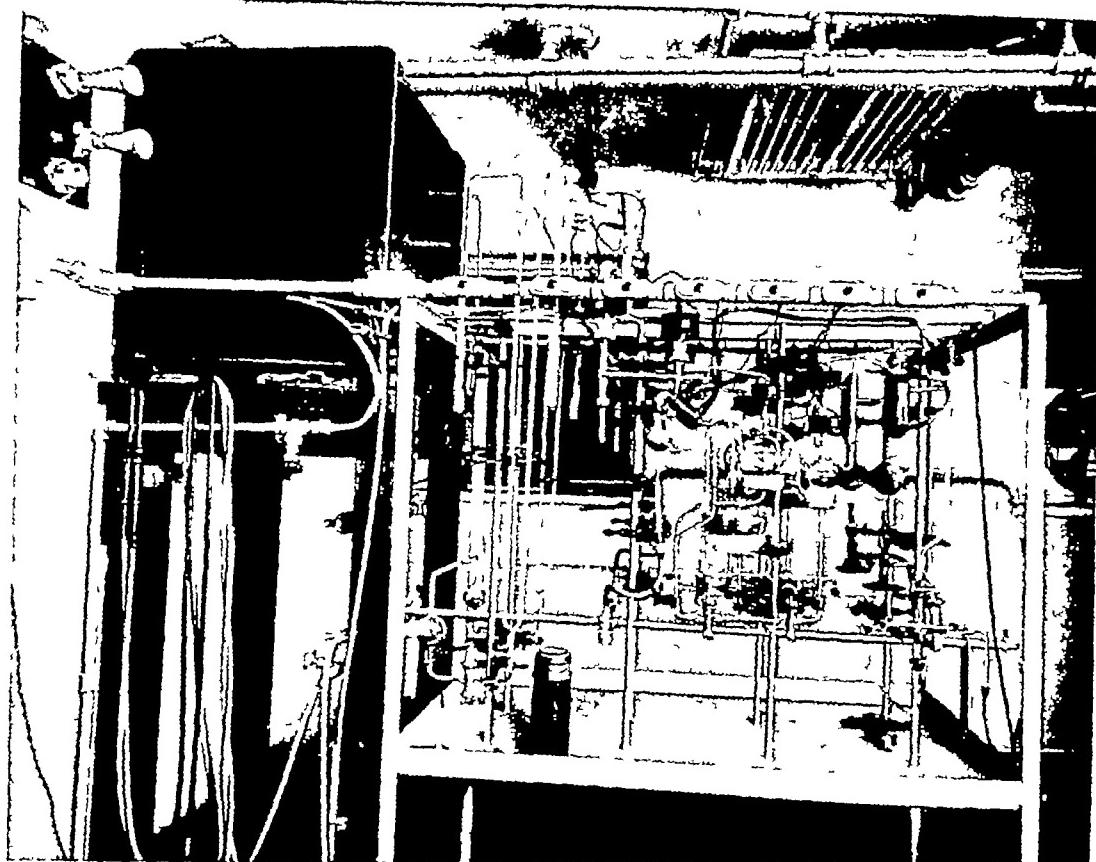


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done if the water is allowed to remain in *E* for several pumpings

With as small an amount of radium as 200 mg in the plant, it is quite easy to supply gold implants 4 mm long, 0.15 mm internal diameter, containing 4 mc of radon

SUMMARY

The outstanding qualities of this apparatus are

1 Once installed, no parts or chemicals need be renewed or replaced, except the implant tubing

2 Heavy Pyrex glass is used throughout, which makes the apparatus stronger and less apt to become broken

3 Radon can be easily, efficiently, and quickly purified and forced into gold or glass tubes with little danger of over-exposure of the attendant to gamma rays

REFERENCES

- (1) ALLEN, ALEXANDER, J. A New Model Radium Emanation Plant. *Jour Cancer Research*, August, 1930, XIV, 461-465
- (2) FAILLA, G. U. S. Patent No. 1,609,614

DESCENDING INTRAVENOUS PYELOGRAPHY

By CARLOS HEUSER, M.D., BUENOS AIRES,
ARGENTINA

Translation by JOSEPH MALDONADO, M.D.,
NEW ORLEANS, LA

It has been observed that, in pregnant women, intravenous pyelography is more successful than in non-pregnant women and this has proved true in cases in which the two iodine compounds, uroselectan and abrodil, have been used. The success of this method of visualization in pregnant women has been explained by the fact that the fetus makes pressure either on the iliopsoas muscle or on the ureters as they cross the brim of the pelvis, or just before they enter the bladder.

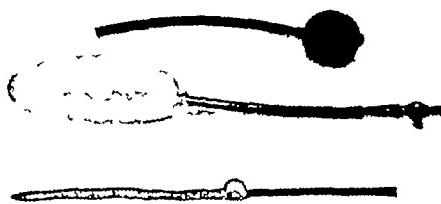


Fig. 1 I, The collapsed balloon, II, Air bulb, III, Distended balloon

This observation incited us to try to imitate fetal pressure. To produce the necessary effect we have to apply pressure either on the bladder or the ureters, as the fetus applies its pressure. In the German literature on this subject, we read that pressure is applied over the abdomen to compress the ureters. This, obviously, is difficult and at times impossible of accomplishment, especially in obese individuals.

When we realized the faults of the abdominal pressure method, we began to work out a method of imitating fetal pressure in the most physiologic manner possible. This, we thought, could be accomplished by filling the large intestine and also the bladder with air, thus producing the desired pressure on the ureters as they enter the bladder. In this manner we could bring out

- (1) The outline of the bladder,
- (2) The kidney outline, which stands out better because the pressure on the ureters keeps the urine from flowing too rapidly into the bladder, allowing the radiologist to study the flow of opaque substances from the kidney.

The procedure, which we term "artificial pregnancy," is as follows. The bladder is filled with 100 c.c. of air. Now if the large intestine is also distended, all the air goes to the transverse portion, causing blurring of the shadows sought, i.e., kidneys and ureters so that air in the intestine is a dis-

J, forcing the radon ahead of it past V_6 into *K*. The mercury is then lowered in *J* but the radon remains behind, trapped beyond valve V_6 in *K*. V_6 automatically forms a mercury-sealed stopper as the mercury level is lowered into *J*. In practice, less than 1 or 2 per cent of the radon remains behind after the first stroke of this Toppler pump. If on the second stroke 1 per cent of the remainder is left, there is little use for the third stroke §.

If no gold implants are wanted, the radon is compressed to the desired volume into the end of *K* and sealed off with a tiny gas flame, being later separated into implants of the desired size. The volume is regulated in the following manner: if stop-cocks S_5 and S_6 are opened, there will be a pressure of 1 atmosphere on the surface of the mercury in *M* and, since the difference in height between the surface and *K* or *L* is approximately 38 cm, the radon will be compressed to approximately $\frac{1}{2}$ atmosphere. This is a desirable pressure for sealing glass radon implants. However, the radon can be further compressed by closing stop-cocks S_2 and S_3 and applying a pressure on the mercury surface in valve V_6 by opening cock S_4 . After taking off the radon the vacuum should immediately be re-established above V_6 before opening S_2 or S_3 .

In case it is desired to put all the radon into gold implants, cocks S_2 and S_3 are opened and the mercury lowered in *J* to about *c* and in *N* to below *c*. Valve V_6 is opened and practically all the radon diffuses into *J* and *N*. V_6 is closed and the mercury is caused to rise in *J*, forcing the radon into *N*. The mercury is then caused to rise in *N*. Valve V_6 has acted automatically to prevent the mercury from entering the gold tube *L*. Its action is stopped by applying a magnetic field which holds it down against the buoyant

force of the mercury. *V* then acts as did V_6 , and *N*, S_3 , and *M* becomes a Toppler pump, which after one or two strokes transfers practically all the radon from *K* into *L*. The radon is again compressed to the desired volume, sealed off with a special pair of pliers, and later cut into implants of the desired length. If all the radon was not forced into *L*, it can be returned to *K* by reversing the process.

In case, for instance, it is desired to put only one-third of the radon into gold seeds (the volume of *N* is equal to one-fourth that of *J*), open stop-cock S_2 and allow the mercury to lower until *J* is one-half emptied. Close S_2 . Lower mercury in *N* below *c* and open V_6 . Shortly the radon will come to equilibrium and one-third will be in *N* and two-thirds in *J*. Allow the mercury to rise in *N*, then in *J*, forcing the one-third into *L* and the two-thirds into *K*. By adjusting the mercury level in *J*, the radon can be divided roughly into any amounts between *L* and *K*. To open *T* for re-evacuation purposes, lower the mercury in *N* below *c*, leaving *J* filled. Open stop-cocks S_6 and then S_4 , allowing air pressure to force the mercury from *T* into *N*.

At this stage there will be a certain amount of condensed water vapor in *E* and it is desired to transport this back into *A*. Close valve V_1 , which prevents water from passing from *A* to *B*. Move the Dewar flask containing the solid CO_2 and acetone from *E* to *B*, having first closed valve V_5 to prevent the KOH in *F* from absorbing the freed water vapor. Enough heat will soon be supplied from the room to melt the ice in *E*. *C* is then opened and the water soon migrates to *B*. Again close *C*, remove the Dewar flask, and allow the ice to melt and the water to become warm. Open V_1 and the water will slowly migrate back to *A*, it being the cooler place. The migration is accelerated if the heat from an electric heater is allowed to fall on *B*. No harm is

§ The volume of the tubing between *J* and *J* (*ab*) is very small compared to the volume of *J*; hence the amount of radon left in *ab* after the second stroke is negligible, providing, of course, that the pump *J* had in the beginning drawn all the radon from the purification chambers.

This shadow, which was somewhat oval in shape, did not conform to the haustral markings of the colon, which could be seen below it. The finding seemed indicative of free air in the abdomen. For verification, a chest

film (Fig. 2) was made with the patient erect, and a small amount of air was seen under each diaphragm.

At operation, a perforated duodenal ulcer was found.

First X-ray Examination of Lungs of Students—For the first time in the educational history of this country, a policy of subjecting the lungs of all members of the entering classes in all departments of a university to X-ray examination has been adopted. This measure was put into practice by Yale University as a further means of safeguarding the health of its students, an annual report of the Department of University Health states:

The X-ray films are made with a view to determining the presence of tuberculosis in any of its manifestations. All students whose

chest films show indications of trouble are to be carefully followed during their college courses and examination of their chests will be made at least once a year.

"A certain number of them should thus be saved from a breakdown, and a single one so saved would justify the expense," the report stated.

Stereoscopic X-ray films were made last year of 1,602 new students. A total of 283 students, or 17.7 per cent of those examined, gave evidence of an amount of infection potentially dangerous but, in most cases, not destined to cause trouble.—*Science Service*

advantage rather than an aid To meet this obstacle the author devised a rubber balloon attached to a tube with a key, which controls the air passage at the end A rubber bulb is used to inject the air With a forceps, the collapsed balloon (I) is inserted into the rectum When one feels that the balloon is on the level with the base of the bladder, the air is injected gradually, using the bulb (II) When the balloon is dilated, the key is closed, stopping the flow of air The balloon then remains distended (III), pressing against the bladder base

While the method described above is quite effective, still we have found it advantageous to use at the same time abdominal pressure by means of a binder which prevents the balloon from passing up the rectum past the base of the bladder, where the pressure is desired The pressure at the

base of the bladder should be continuous for from four to five minutes before the X-ray plates are made

SUBHEPATIC PNEUMOPERITONEUM DEMONSTRATED IN GALL-BLADDER FILMS

By ARTHUR BETTS, M.D.,
SPOKANE, WASHINGTON

Pneumoperitoneum is a well-established sign of perforation of the gastro-intestinal tract The following case is reported because of the characteristic gas shadow obtained in the films of the gall-bladder region

B H, male, was admitted to St. Luke's Hospital on May 29, 1931, and immediately referred to the X-ray Department for cholecystography On the preliminary roentgenograms (Fig 1) of the gall-bladder region, there was a dark shadow lying beneath the liver and above the kidney



Fig 1 Air shadow between eleventh and twelfth



Fig 2 Free air under diaphragm with patient erect

should be paid to their durability and ease of operation than their beauty

Accuracy—The energy put into the X-ray tube must be measured by a milliammeter and a kilovoltmeter which has been calibrated under working conditions with a sphere gap. The daily use of a sphere gap is not necessary, as a kilovoltmeter can be depended upon to furnish a constant index of voltage, although it may not indicate the actual voltage.

The output of radiation from the tube cannot be determined by formulæ. It can be roughly estimated from the effect of experimental exposures on the untanned skin. A far more reliable procedure is to have the output measured at regular intervals by an instrument calibrated in absolute units. The time is fast approaching, if it is not here now, when the ownership and regular use of a measuring instrument will be considered essential to accurate roentgenotherapy.

Finally, the amount of apparatus to be purchased and its capacity depends upon the number of patients to be treated. The articles enumerated in the foregoing paragraph are the bare essentials. As patients become more numerous, other pieces of equipment may be added, such as transformers and tubes of greater capacity, water-cooled tubes, sphere gaps, stabilizers and electroscopes, water phantoms, and spectrographs for experimental study and research.

ARTHUR W ERSKINE, M D
Cedar Rapids, Iowa

COMMUNICATIONS PROGRAM OF THE AMERICAN RADIUM SOCIETY

NEW ORLEANS, MAY 9-10, 1932

May 9—10 00 A M

Symposium on Cancer of the Skin

Chairman W S NEWCOMET, M D, Philadelphia, Pa

- 1 LAURENCE R TAUSSIG, M D, San Francisco, Calif
"The Treatment of Epithelioma of the Skin Indications for Radium Therapy"
- 2 MAX CUTLER, M D, Chicago, Ill (By invitation)
"Radiation Treatment of Cancer of the Skin"
- 3 C H MARTIN, M D, Dallas, Texas
"The Advantages of Radiation in the Treatment of Skin Carcinoma"
- 4 G MILLER MACKEE, M D, New York, (By invitation)
"Methods of Treatment of Cancer of the Skin"

Discussion to be opened by LESTER HOLANDER, M D, Pittsburgh, Pa

Discussants WILLIAM H CAMERON, M D, New York, N Y, LEROY SANTE, M D, St Louis, Mo

- 5 RUSSELL S FERGUSON, M D, New York, N Y
"The Effect of External Radiation on the Hormone of the Anterior Hypophysis in the Treatment of Teratoma Testis"

2 00 P M

- 6 D G MORTON, M D, San Francisco, Calif (By invitation)
"Cancer of the Cervix Uteri"
- 7 HENRY SCHMITZ, M D, Chicago, Ill
"The Results Obtained with the Scattered Fraction Method of Irradiation of Carcinoma of the Uterine Cervix"

Symposium on Radiation Therapy for Uterine Hemorrhage of Non-malignant Origin

Chairman E H SKINNER, M D, Kansas City, Mo

- 8 A U DESJARDINS, M D, Rochester, Minn
"Radiotherapy for Benign Hemorrhage of the Uterus"

EDITORIAL

LEON J MERVILLE, MD

Editor

BUNDY ALLEN, MD

Associate Editor

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THE SELECTION OF THERAPY APPARATUS¹

The development of modern roentgenotherapy has brought into common use a great deal of expensive and delicate apparatus. It is not surprising that the young roentgenologist, trained in a great university which is equipped regardless of expense so that a large number of patients can be treated rapidly and efficiently, may assume that a similar expenditure is essential on his part. He may wonder how the income from the few patients he can expect to have will justify what seems to be a large, but necessary, investment. In this time of economic adjustment it is prudent to try to separate necessities from luxuries.

The minimum requirements for modern roentgenotherapy apparatus are that it will permit any required dose of rays to be delivered to any part of the body safely and accurately.

Capacity — Increasing the capacity of transformers and tubes enables us to produce X-rays of increased intensity and hardness. Great intensity, from the use of 200 KV transformers and deep therapy or water-cooled tubes, has one, and only one, distinct advantage. While very hard X-rays save time and allow us to treat many patients rapidly, they have not yet been shown to

possess any peculiar therapeutic virtue. They do have greater penetrative power, permitting a closer approach to homogeneous distribution. This has the practical advantage of proportionately decreasing the amount of radiation absorbed by the healthy tissues surrounding a deep lesion, and, theoretically at least, lessening the danger of severe constitutional reactions. Transformers and tubes capable of operation at from 130 to 140 KV meet the minimum requirement, that is, they will deliver any required dose to any part of the body. If the economical limit of a 40 cm anode-skin-distance and 0.25 mm copper filters are used with 140 K.V., the depth-dose-percentage at 10 cm is 30 as compared to 39.3 with a 50 cm anode-skin-distance and 0.5 mm copper with 200 kilovolts. The time for each area is about one and one-half times as long, and more areas are necessary. If the anode-skin-distance is increased to 70 cm and the filter thickness to 0.5 mm copper, the depth-dose-percentage is 38.6, the distribution comparing well enough with that obtained by a high voltage technic. We may conclude, therefore, that a well-trained roentgenologist who is willing to spend his time need not hesitate to accept patients for treatment because the capacity of his transformer and tube is only 140 kilovolts.

Safety — Danger to the patient from electrical shock, and from stray radiation as well, can be entirely eliminated by completely surrounding the tube with lead and by guarding with grounded metal all wires that can possibly be touched by the patient. This means that tube-stands of the open-bowl type should be abandoned and replaced by the cylinder, the couch, or the slanting wall. These need not be ornate, more attention

¹Read before the Radiological Society of North America
at the Seventeenth Annual Meeting, at St. Louis Nov 30-

THE AMERICAN COLLEGE OF RADIOLOGY

The annual convocation and dinner will be held at the St Charles Hotel, New Orleans. The business meeting of the Chancellors will take place at 7:00 P.M. Tuesday, May 10th.

All the Fellows will convene at 6:30 P.M., Wednesday, May 11. The first order of business on that evening will be the presentation of the candidates to the President, A. C. Christie, M.D., who will conduct the convocational exercises and confer the degrees, after which comes the dinner, followed by the President's address, reports from the Board of Chancellors, and the regular business session for the Fellows.

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AMERICAN MEDICAL ASSOCIATION SECTION ON RADIOLOGY

May 9-13, 1932

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The program of the Section on Radiology will be published in the *Journal of the American Medical Association*, to which our readers are referred.

BOOK REVIEWS

A RADILOGICAL STUDY OF THE PARA-NASAL SINUSES AND MASTOIDS By AMEDÉE GRANGER, K.C.B., K.C.I., M.D., F.A.C.R., Professor of Radiology, Louisiana State University Medical Center, Director of the Department of Radiology, Louisiana State Charity Hospital, New Orleans, Gold Medal of the Radiological Society of North America in 1926, Gold Academic Palms of France in 1929. Contains 186 pages and 113 engravings. Published by Lea & Febiger, Philadelphia, 1932. Price, \$5.50.

This work, as stated by the author, is a compilation of a number of articles which have appeared from time to time in the current literature. The section devoted to the para-nasal sinuses deals largely with the posterior ethmoids and sphenoids, as it is Granger's belief that the other sinuses can usually be examined satisfactorily by the rhinologist. His observation that a small amount of pus in the maxillary sinus usually collects along the nasal wall is particularly interesting to the reviewer.

- 9 J A CORSCADEN M D , New York,
N Y
"Treatment of Uterine Fibroids"
- 10 O L NORSWORTHY, M D , San Antonio, Texas
"Benign Uterine Neoplasms, with Special Reference to Treatment"
- Discussion of papers Nos 6-10 to be opened by C JEFF MILLER, M D , New Orleans, La (by invitation), and W P HEALY, M D , New York N Y
- May 10—9 30 A M
- Symposium on Cervical Nodes Metastatic from Intra-oral Cancer
- Chairman* D M LENZ, M D , New York, N Y
- 11 VILRAY P BLAIR, M D , St Louis, Mo (By invitation)
"Care of the Lymphatic Drainage Areas of the Neck"
- 12 CALVIN B STEWART, M D , Atlanta, Ga (By invitation)
"Neck Care in Intra-oral Malignancies"
- 13 ELLIS FISCHEL, M D , St Louis, Mo (By invitation.)
"Treatment of Cervical Nodes Metastatic from Intra-oral Cancer"
- 14 JAMES J DUFFY, M D New York, N Y
"Management of Cervical Nodes Metastatic from Intra-oral Cancer"
- Discussion to be opened by EDWIN C ERNST, M D , St Louis, Mo
- Discussants URBAN MAES, M D , New Orleans, La. (by invitation), and G W GRIER, M D , Pittsburgh, Pa
- 15 HENRY K. PANCOAST, M D E P PENDERGRASS M D , and GABRIEL TUCKER, M D (by invitation), Philadelphia, Pa.
"The Treatment of Appropriate Cases
- of Cancer of the Bronchus and Esophagus by Supplemental Radon Implantation"
- Discussion to be opened by HENRY J ULLMANN, M D , Santa Barbara, Calif
- 2 00 P M
- 16 EDITH H QUIMBY, M A , New York, N Y (By invitation)
"Dosage from Long Radium or Radon Needles"
- Discussion to be opened by J L WEATHERWAX, Ph D , Philadelphia Pa (By invitation)
- Symposium on Cancer of the Lip
- Chairman* FRANK E SIMPSON, M D , Chicago, Ill
- 17 C C LUND, M D , Boston, Mass (By invitation)
"Analysis of the Treatment of Cancer of the Lip at the Huuntingdon Hospital from 1918 to 1926"
- 18 B F SCHREINER, M D , and W L MATTICK, M D , Buffalo, N Y (By invitation)
"Five-year End-results in the Treatment of Cancer of the Lip (New York State Institute for the Study of Malignant Diseases)"
- 19 O H WANGENSTEEN M D Minneapolis, Minn
"Report of Cases of Cancer of the Lip at Cancer Institute University of Minnesota Medical School"
- 20 JEROME WEBSTER, M D New York N Y
"The Operative Treatment of Epithelioma of the Lip"
- Discussion to be opened by ALTON OCHSNER, M D New Orleans La (By invitation)
- Discussant ROLLIN H STEVENS M D , Detroit Mich

Granger makes the observation that in infants under about three years of age, the mastoid cells are so undeveloped that the anterior wall of the lateral sinus cannot be seen, since there is no pneumatization in front of it to act as a contrasting medium. In these infants if the mastoid becomes infected and the bone destroyed over this area, the anterior wall of the sinus becomes distinctly visible. In many cases this new sign of mastoid disease has been the means of diagnosing mastoid abscess when it was not possible to do so by other means.

Granger believes that treatment with very mild doses of X-rays in infantile mastoiditis before the stage of pus formation may result in resolution of the process.

There are also many beautiful illustrations in this section of the book which includes demonstrations of the technic of his positions as well as many examples of mastoiditis in all stages, cholesteatomas, acoustic tumors, and infantile mastoiditis, recognized by the unusually clear visualization of the anterior sinus wall.

Altogether this little book is a very valuable addition to the literature of roentgenology of the sinuses and mastoids.

G W GRIER, M D

STUDIES IN THE PHOTO-ACTIVITY AND THERAPY OF THE TUNGSTEN-TITANIUM ARC By J. BURDON-COOPER, M D, B S, B Sc (Duch), F R C S E, D O (Oxon), F C S, and A ROBERTS, T D, F R C S E, M R C S Eng (Bath) Pages 85, with 21 plates Published by William Wood & Co, New York, 1931 Price \$3 50

This monograph has been written in order to supply information gained by the authors during the last three years with a therapeutic lamp using a composite electrode of tungsten and titanium. In the first

part the emission of the tungsten-titanium arc is analyzed, mostly by the spectral method, a large number of spectrograms is appended. The results can be summarized as follows. The spectrum of the arc contains about 50 per cent short erythema-producing rays, 25 per cent long non-erythema-producing rays, and 25 per cent visible rays in the photo-active part of the light spectrum. This compares very favorably with the pure tungsten arc, which, according to the authors, has, for instance, only 42 per cent of short erythema-producing rays. The times for producing identical skin reactions are 1 8 1 in favor of the tungsten-titanium arc.

In the second and clinical part of the book the clinical model of this arc, known as the Crombie lamp, is described with its accessories. Detailed instructions are then given as to the proper use of the equipment. The general effects following the exposure are also outlined, they are illustrated by excerpts from a patient's letter describing his experience after the use of this lamp. As appears from the next chapter, beneficial results will be obtained in eczema, acne, alopecia, general debility, circulatory disturbances, asthma, anemia, and rheumatic conditions. Numerous histories taken from the files of Dr Roberts are quoted. In conclusion, the authors state that this monograph is offered as the "groundwork of a sincere conviction that the tungsten-titanium arc not only has potential energy and characteristics that are in some respects unique, but also possesses a clinical value in general actinotherapy which we cannot well afford to ignore."

E A P

as is also the statement that a fluid level can seldom be observed, confirming my own belief

Likewise, his experience with iodized oil would seem to be that of many other radiologists, namely, that this method serves only to demonstrate more vividly lesions which may be observed on properly made films without the use of oil

In the examination of the sphenoids, Granger has evolved a position which throws the roof of these sinuses in clear relief, and, even if not accepted as a substitute for all other positions, is undoubtedly a valuable addition to the study of these cavities. The author stresses at considerable length the necessity of following his technic rigidly if his own results are to be duplicated. Briefly, his technic is as follows:

1. The patient must lie prone with the head tilted beyond the horizontal. The object of this position is to cause any pus in the sphenoids to run forward against the anterior wall, as it is this portion of the sinuses which is demonstrated by his position.

2. An angle block tilted 17 degrees beyond the horizontal must be used to support the patient's face.

3. This angle block must have a false top with a hole in it through which the nose projects, the film cassette being beneath.

4. With the patient in position, the face must rest firmly against the forehead and alveolar process in the upper incisor region.

5. The central ray is projected directly downward through the tragus of the ear.

6. If all factors are correct the shadow of the petrous portion of the temporal bone will fall entirely within the orbit, and the roof of the sphenoids will be represented by a convex line at the base of the frontal sinuses.

If pus is present in the sphenoids the lower border of this line will be obliterated because the pus will be lying right up against it. The area below the line will be opaque for the same reason. Polypi produce a similar appearance, although the shadow is usually more dense. Hyperplastic sinusitis produces a rarefaction of the sinus walls, and the line is less distinct and broadened, with the lower border difficult to recognize.

The author believes that the greatest use of the lateral view is to measure the distance between the anterior nasal spine and the anterior wall of the sphenoid, so that the surgeon may know definitely when he is in the sphenoid sinus. For this reason, he always makes his lateral views at a distance of six feet so as to minimize the magnification of this measurement. The numerous beautiful illustrations of specimen skulls with the sinuses filled with opaque material and the great variety of cases demonstrating actual pathology serve to convince one of the value of the author's methods.

In the section on mastoids, Granger describes his modification of Arcelin's position, first reported by him in 1926. This position gives an approximate anteroposterior view of the mastoid and is especially valuable to demonstrate the tip cells. In the reviewer's opinion, this view is an indispensable part of the X-ray examination of the mastoid. Granger's method of making this view is superior to the original Arcelin position in that the patient lies on his back instead of on his face, certainly an easier position for the patient. The head rests on an angle block of 17 degrees, inclined toward the feet. The head is rotated laterally away from the side to be examined, the inclination being 40 degrees beyond the vertical. The central ray is focused directly downward through the mastoid, giving an approximate anteroposterior view.

Granger uses a special head rest with a support for the side of the face which makes it easy to measure the desired angle. In this view the cells in the tip and those directly above are brought into relief in a way which is impossible in any other view. By this view, not only opacity of the cells, but destruction of cell partitions and even erosion of the cortex (Bezold mastoid) can be recognized.

In some cases of furunculosis of the auditory canal, with swelling of the external ear, the mastoid area may appear opaque in the usual Law position, but in Granger's position it will be seen that the pathology is not actually in the mastoid cells. The same observation applies to periostitis of the mastoid tip. Tumors of the acoustic nerve are also well demonstrated by this position.

ABSTRACTS OF CURRENT LITERATURE

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MUNICIPAL INSTITUTE OF RADI-
OLOGY AND ELECTROLOGY,
BUENOS AIRES

By CARLOS HEUSER, M.D.,
BUENOS AIRES, ARGENTINA

Translation by JOSEPH MALDONADO, M.D.,
New Orleans, La

Last year a new Institute was opened, its object being to give patients sent by attending physicians of the various municipal

treatment, electrotherapy, radium therapy, and kinesitherapy

Besides, the Institute has access to 80 beds where patients can be placed while they are being treated. There is a chemical laboratory, rooms for roentgenography, and rooms for electrocardiography and X-ray diagnosis of the respiratory, digestive, and genitourinary tracts, fractures and dental lesions. There is a department for X-ray therapy



Municipal Institute of Radiology and Electrology, Buenos Aires

hospitals in the city the necessary radiologic treatment. It is a central laboratory as well as a therapy center. Any patient who needs either radiologic or electric treatment and who is in good enough condition to be moved from his hospital is brought here. The necessary tests are made on the patient and a report is sent to the physician in charge.

The Institute, which is under the direction of Dr. Umberto Caselli, is subdivided into departments for X-ray, both diagnosis and

(both deep and superficial) as well as divisions for radium therapy, diathermy, electrotherapy, and electrodiagnosis. The department for local and general ultra-violet radiation is under the direction of Dr. Fernández. Each of these departments has its own attending chief, assistants and nurses, and equipment of apparatus.

We have been informed that this Institute is the most complete and best equipped in the world.

six to eighteen hours. After the bleeding is controlled, fulguration may be done and X-radiation given. In the author's opinion, cystotomy should be avoided, if possible, and resorted to only as a life-saving measure.

The author reports several cases of tumors of the urinary bladder and discusses the methods of treatment employed in these cases. Favorable results were obtained in this series following the instillation of a 2 per cent solution of urea and quinine hydrochloride. The author believes that this chemical is not greatly different from fulguration and radiation in its action upon the tissues, for these agents all sclerose the blood vessels and are anesthetic in their action.

J N ANÉ, M D

BONE (DIAGNOSIS)

Lines of Arrested Growth in the Long Bones in Childhood the Correlation of Histologic and Radiographic Appearances in Clinical and Experimental Conditions H A Harris British Jour Radiol, November, 1931, IV, 561-588

The author studied intensively the development, appearance, and disappearance of the transverse lines of increased density seen not infrequently in the ends of long bones a little distance proximal to the epiphyses. These lines are similar to the lines of epiphyseal union in that both groups obey certain laws of nature. First, the density of the line is proportionate to the severity of the illness; second, the arrest of growth is manifested at the more rapidly growing ends of the long bones, that is, at the knee, ankle, and wrist. The extent to and rate at which these lines tend to disappear bear some relation to the stresses and strains in the neighborhood of the joint and to the degree of functional usage of the part following the illness which produced the line. Hence, the lines are more apt to persist in moribund joints, such as the ankle and knee, but the more active the individual following the development of the lines of arrested growth, the more remodelling of bone and absorption of the lines is apt to occur. Finally, with increasing age of all individuals, whether they are leading active or sedentary lives, there is greater probability of eventual disappearance of the lines as a part of the process of absorption and deposition which is continually going on in living bone.

As a result of this study the writer believes that there may be a practical medico-legal application for identification of individuals, also that studies of the long bones, such as the knee or ankle regions, might prove of value to insurance companies. Absence of lines of arrested growth would indicate either absence of severe illness during the growth

period or active life thereafter, with subsequent removal of all evidence from the bones of the periods of disturbance in growth.

J E HABBE, M D

Halisteresis of the Epiphyses on the Basis of Endocrine Disturbances Friedrich Tebrügge Röntgenpraxis, Nov 1, 1931, III, 988-990

It is known that rickets, osteomalacia, and osteitis fibrosa are not local diseases of the bones, but are caused by severe disturbances in the calcium metabolism. Many authors believe that an hyperparathyreosis is responsible for osteitis fibrosa generalisata (Recklinghausen).

In an 18-year-old boy who complained of rheumatic pains, especially in the shoulders, roentgenograms revealed relatively wide epiphyseal lines and quite marked osteoporosis of the epiphyses themselves, especially in the shoulders and hips. Chemical tests showed a pathologic amount of calcium excretion and a high calcium level in the blood (from 25 to 30 mg per cent). The clinical and roentgenologic picture points to a hyperfunction of the parathyroids.

H W HEPKE, M D

Total Luxation of the Talus P Pfahler Schweiz med Wchnschr, Aug 8, 1931, LXI, 768, 769

Complete luxation of the talus without fracture is an unusual occurrence. Kronlein found no dislocations in 400 cases of luxation, the author having observed no cases previously. Bohler had never seen a dislocation similar to the one the author describes and illustrates (a medial and anterior dislocation).

A 33-year-old man fell from a height of 35 meters, striking the inner surface of his foot, in plantar flexion, against a circular object. The force was the opposite to that usually described as being responsible for this type of injury.

H C OCHSNER M D

The Use of Roentgen Rays in Fractures (Technic and Organization) Lorenz Böhler München med Wchnschr, Sept 18, 1931, LXXVIII, 1609-1613

The diagnosis of a fracture can usually be made by an experienced physician without the aid of the X-ray, but X-rays are absolutely essential for treatment and in the event of industrial compensation cases. It is especially unwise if the physician ad-

APPARATUS

Gastric Endophotography M G Spehl Arch d mal de l'app digestif, October, 1931, XXI, 968, 969

The author gives a technical description of the apparatus, which consists essentially of a photographic tube and a condenser-transformer. It is best to use a current of 220 volts and 6 amperes. The instrument can be easily inserted if it is introduced obliquely.

Before taking plates it is important to obtain sufficient inflation, so that the instrument is from about 5 to 6 cm away from the gastric wall.

The greatest source of error lies in the fact that folds of mucosa resemble lesions at times. Some of the findings have been the recognition of hypertrophied and atrophied mucosa, various types of small and large ulcers, including plaques of small bullæ in a case of pulmonary tuberculosis, suggestive of gastric tuberculosis. The absence of large folds on the smaller curvature was also noticed.

Colored photography has been tried, but it is very difficult to perform.

B J DELAUREAL, M D

Photo-electric Tube. Archie J McMaster and Charles E. Parson (to G M Laboratories, Inc.) U S Patent 1,831,314, Nov 10, 1931

A light-sensitive surface is provided on a cathode of a photo-electric tube by depositing an alkali metal, such as Cs, on the cathode and subsequently admitting O to the tube to oxidize the metal, and expelling the excess of the metal.

CHEMICAL ABSTRACTS

THE APPENDIX

Reflex Phenomena in Chronic Appendicitis George Coote Field British Jour Radiol, October, 1931, IV, 504-506

The writer considers the three following signs or symptoms to constitute an important triad in the diagnosis of "chronic appendicular lesion." Onset of gastric discomfort within from three to four hours after eating, no gastric or duodenal lesion radiologically demonstrable, and reflex pyloric spasm seen roentgenoscopically, with associated increase in gastric peristalsis following pressure in the right iliac fossa. These roentgenologic findings were more often seen associated with non-visualization of the appendix, the appendix at operation often being found to be retrocecal in position. With the

appendix lying free of the cecum and with no associated cecal inflammation, the reflex could not be elicited.

J E HABBE, M D

THE BLADDER

Tumors of the Urinary Bladder Henry A Brady Med Bull Veterans' Administration, December, 1931, VII, 1165-1169

The author attempts to explain the development of bladder tumors as an exaggeration of a physiologic process. Continual irritation and the promotion of hyperemia serve to give unnatural impetus to the inherent power of cells to proliferate and create new tissue in the process of repair. In the end, "super cells" are thus created which are so powerful that these crowd out and break through and invade other tissues. In this manner physiologic phenomena are converted into a pathologic process.

In the bladder we have the ideal field for the inception and development of tumors. Long-continued irritation from unrecognized infection, together with the excessive acidity or alkalinity which accompanies it, furnishes the necessary stimulus until the tumor has reached the proportions of a malignancy.

Papilloma is the most frequent newgrowth found in the bladder, and carcinoma, which is thought to be an evolution of the papilloma, is the next tumor of importance in order of frequency. The adenoma is usually an invasion from the prostate gland. Histologically these tumors are composed of a fine framework of connective tissue in which there is a network of small blood vessels, covered at first with epithelium and later with the tissues which they have invaded. These tumors are usually pedunculated.

The symptomatology of bladder tumors varies with the size, location, character, and tissue involvement. Hematuria has long been considered the cardinal symptom of vesical tumors. Cystoscopic examination is considered of great value in the diagnosis as well as in the determination of the size, location, and character of the tumor and the type of therapy to be instituted.

The author is of the opinion that early fulguration through the cystoscope offers the most favorable results. The patient should be carefully examined every three months for at least two years after the tumor has completely disappeared. Radiation should be combined with fulguration in the treatment of tumors which have attained considerable size, even though they fail to show any malignant change. Radium is found valuable in many cases, especially when used to control hemorrhage. From 50 to 100 milligrams may be applied for a period of from

nose. It is especially difficult to differentiate it from syphilis, osteomyelitis, and tumors of the long bones. The following clinical and roentgenologic points are presented in assisting one in making an accurate diagnosis.

(1) The bone lesions are multiple, (2) the bones of the forearms are most often affected, (3) the sclerotic changes are mild, (4) sequestra are frequently present, (5) the lesion is usually confined to the middle of the shaft, (6) the soft tissues are swollen, (7) the temperature is elevated, (8) suppuration is abundant, (9) youthfulness of the patient, and (10) negative Wassermann reaction.

A series of roentgenograms accompanies the paper, illustrating the gradual improvement of the bone lesions under the treatment.

SAMUEL BROWN, M.D.

Acute Suppurative Conditions of the Hip Joint
Guy A Caldwell Jour Am Med Assn, Jan 2,
1932, XCVIII, 37-40

The author includes all infectious processes that produce pus within the capsule of the hip joint, previously described acute infectious arthritis, acute suppurative arthritis, acute epiphysitis, acute pyogenic arthritis, and septic joints. Penetrating wounds of the hip, with infection and gonorrhreal arthritis, have purposely been omitted, because they are rarely seen in children.

A summary of the records of seventeen patients with eighteen acutely involved hip joints is presented to show pus found in these joints resultant from a hematogenous infection of the synovial lining, femoral neck (intra-articular portion), capital epiphysis of the femur, and pelvic bones forming the acetabulum.

The anatomy and pathology are reviewed with a brief summary of the symptoms and diagnosis. Treatment involves early emptying of the joint and prevention of reaccumulation of pus.

A review of the end-results indicates that ankylosis or pathologic dislocation is the usual sequel when the primary site of infection is in the intra-articular bony structures, whereas an excellent functional result is the rule when the process begins in the synovial membrane.

Röntgenograms should be made after drainage to determine whether or not there is bone involvement; if bone destruction is apparent, drainage must be provided by some other route than through the hip joint.

C G SUTHERLAND, M.D.

CANCER (DIAGNOSIS)

The Dilatation of the Duodenum in the Case of a Circumferential Lesion of the Upper Portions of the Jejunum

A M Rybak Röntgenpraxis, Oct 15, 1931, III,
932-934

Malignant tumors of the jejunum are very rare. A case is described in which a marked dilatation of the entire duodenum, with retention in the duodenum for twenty-four hours, was found on roentgenologic examination. It is impossible, in the author's opinion, to differentiate roentgenologically a malignant tumor leading to obstruction from an obstruction produced by other causes (adhesions, tuberculous glands, etc.). The clinical history (marked loss of weight) and other clinical findings (tumor, blood in the feces) must help to determine the etiology.

H W HEIKE, M.D.

CANCER (THERAPY)

Pre- and Post-operative Treatment of Cancer of the Breast by Radiation (Metastasis Excluded)
J E A Lynham British Jour Radiol, November,
1931, IV, 534-560

Search of the literature by the author reveals the fact that from 75 to 95 per cent of all cases of cancer of the breast are in the stage of skin involvement, adhesions to the muscles, glandular invasion, or wide-spread metastases when first submitted to medical care. Many of these cases are obviously beyond any hope of actual benefit by surgery.

The complex processes involved, whereby irradiation can effect such changes in the tissues as to inhibit malignant growth, bring about its disappearance, or prevent its occurrence, have been widely studied experimentally, but they are not yet well understood. Certain facts of interest from experiments dealing with tumor implantation in animals have been obtained, however, which may have some practical application to the problems of pre- and post-operative irradiation of breast cancers. It has been shown that by giving a certain dose of X-rays to a localized area in animals, the number of tumor implantation "takes" in such irradiated areas is much smaller than the number of "takes" in non-irradiated areas in the same animals. Also, doses of irradiation given to tumor tissue *in vitro* before implantation, which have no inhibiting effect on subsequent growth *in vivo*, will, if given to the tissues after tumor implantation, often cause a disappearance of the tumor. Such experimental results suggest some tumor immunizing effect on the cells of the host by the radiation. In this connection it has been observed that too heavy a dose will fail to inhibit the subsequent tumor growth. There is considerable conformity of opinion derived from experimental work to the effect that cells in a latent state show complete cumulation of several radiations, while cells in an active state show incomplete cumulation. Hence, in practical

tient suggests one A fluoroscopic examination alone often leads the inexperienced to wrong diagnosis, by failure to see a very thin fracture line, as, for instance, in a fracture of the navicular bone of the hand, which sometimes on the radiograph can be seen only by means of a magnifying glass. Films must be taken in two views, frontal and lateral. The central ray must pass through the fracture and the film must be large enough to include the next joint. It is also essential to place the necessary markers on the cassette for identification. A fracture should be radiographed before and after adjustment, and in difficult cases every one or two weeks thereafter, also, after removal of the cast and before the patient is to be discharged.

E A MAY, MD

Avulsion Fracture of the Tibial Tuberosity O Winterstein Schweiz med Wchnschr, Aug 8, 1931, LXI, 761-763

The possibility of confusing Osgood-Schlatter's disease with fracture of the tibial tuberosity has been suggested by Schlatter. The author reports an avulsion fracture somewhat similar to Schlatter's seventh case. A 17-year-old boy, who had previously complained of pain in the knee, met with an injury which caused a detachment of the tuberosity of the right tibia.

H C OCHSNER, MD

Isolated Fracture of the Pisiform W Jaeger Schweiz med Wchnschr, Aug 8, 1931, LXI, 766, 767

Before the advent of the roentgen rays, only one case of fracture of the pisiform bone was reported—that of Guihot, in 1848. Since that time eleven case reports have appeared in the literature. To these the author adds another, with illustrations of the roentgen findings. The occurrence of the rare pisiform secundarium must be excluded by roentgenographs of the opposite hand. Treatment should be conservative, but if pain continues for longer than three months the bone should be removed.

H C OCHSNER, MD

A Case of Isolated Fracture of the Lesser Trochanter Yngve Kewenter Acta Orthopaedica Scandinavica, 1931, II, 160-165

Isolated rupture of the lesser trochanter is to be classed among the fractures of rare occurrence. The author reports a case of this nature in a boy, 12 years of age, who suffered the injury during gymnastic exercises. During the double quick march with long steps the order to halt was given,

when suddenly the hip became "locked." The roentgenogram showed a fracture of the lesser trochanter, with the minor fragment dislocated upwards and medially. The patient's hip was bandaged with plaster of Paris, with the injured leg somewhat flexed, slightly adducted, and rotated outwards.

At the end of two weeks, the patient was discharged, with a slight limp, but otherwise free from symptoms. Three months later, roentgen examination revealed good callus formation between the trochanter and the epiphysis of the femur.

This fracture nearly always occurs between the ages of 12 and 16, and almost exclusively in boys. Diagnosis is not easy to establish, but may be facilitated by the anamnesis and by the presence of Ludloff's symptom, i.e., inability to raise the leg in a sitting position. This symptom, however, may be negative if the fracture is incomplete. But roentgen examination confirms the diagnosis and generally reveals the displaced trochanter, luxated medially and proximally. Prognosis in the case of young patients seems to be invariably favorable.

W W WHITELOCK, Ph D

BONE DISEASES (DIAGNOSIS)

A Rare Picture of a Symmetrical Disease Seen in the Skeletons of the Extremities H U Billig Röntgenpraxis, Nov 1, 1931, III, 984-988.

A case is described which presented bilateral symmetrical areas of density in the upper thirds of both tibias. The distal thirds of both bones of the leg showed less extensive areas of density. The same changes were noted in the distal thirds of the bones of the forearm. All of these bones showed osteitic, specifically osteosclerotic, densities in symmetrical form, more marked near the joints. These findings remained stationary for 18 months. The Wassermann reaction was negative.

The author considers this condition to be indicative of a bone lesion, with features both of melorheostosis (Leri) and osteitis condensans (Sicard).

H W HEPKE, MD

Tuberculous Infection of the Diaphysis of the Long Bones B K Popoff Vestnic Röntgenologii i Radiologii, IV, Nos 2 and 3, p 173

The author reports a case of a child, of the age of one year and seven months, who presented multiple lesions involving the shafts of the long bones. He received a series of ultra-violet and heliotherapy exposures with very good results, although his general condition was very poor at the start.

The author presents a full discussion of tuberculosis of the diaphysis which he states is very rare as a primary affection and is very difficult to diag-

ing to that technic were followed up. One patient died after the operation, due to hemorrhage, two remained well for ten and seven years, respectively, one died seven and one-half years after the operation.

Since 1924, pre-operative irradiation has been given up. Since 1921, radium screens have been used in the axillary region, inserted through drains. In the supraclavicular area 2×66 mg screens are applied, in the infraclavicular area 3×66 mg screens are used, the screens being placed along the blood vessels. Perpendicular to those in the infraclavicular region, 3×66 mg screens are placed in the posterior angle of the wound, for from 50 to 60 hours. This corresponds to from 20 to 24 millicurie doses. After the wound has closed, deep therapy is given spark gap from 35 to 38 cm, 0.5 mm Zn + 1.0 mm Al, 30 cm FSD, 11×16 sq cm field. At least five ports of entry are used, sometimes as many as seven or eight. Each field receives from 3,000 to 4,000 Solomon R units distributed over from 6 to 7 days. Fifty-one cases treated according to this method show the following results. During 1921, five patients were treated, two of whom are still alive, during 1922, ten were treated, none surviving, during 1923, seven were treated, none surviving, during 1924, 26 were treated and seven survived, early in 1925, three were treated and one survived. This means that 7 out of 26, or 27 per cent, are alive seven years following operation and irradiation.

During the period from 1919 to 1924, 13 cases were treated after operation by X-rays only. Four of these are still alive and are in perfect health. One patient died nine years after treatment at the age of 71, and another patient, six years after treatment, from advanced carcinoma of the other breast. Another patient died three years after the operation. In this series, therefore, 30 per cent of the cases were still alive seven years following operation and irradiation.

Since 1925, radium has been applied immediately after operation. A mold of Columbian paste 1.5 cm thick holds from six to eight screens, 10 mg each, filtered through gold equivalent to 20 mm. Pt, and so arranged as to permit homogeneous irradiation. The treatment takes from seventeen to twenty days over an area of from 300 to 400 square centimeters. The total dose amounts to from 250 to 300 millicurie doses, or approximately 40,000 milligram-hours. The exact time of application depends on the condition of the wound. Treatment is given sometimes from 10 to 14 days after operation and sometimes from four to six weeks later. Great care is taken that all radium screens are so arranged that they cover the lymphatics in the infraclavicular region and the area drained by the mammary system. The scar itself, its immediate surroundings as well as the axilla are treated later, usually from two to three months after operation by X-ray deep

therapy. During the first year from eight to ten treatments are given, during the second year five or six, and during the third three or four. In each single sitting about 50 per cent HED are applied. During 1925 and 1926, seven cases were treated this way, and three are still alive. During 1927, nine cases were treated, and three are still living. Five of the six patients treated during 1928 are still alive. During 1929, of fifteen who were treated, ten are alive. Two patients of the latter group have developed metastases.

The author concludes his analysis as follows. During 1925, 51 cases were treated by implantation of radium tubes, after six years, ten, or 20 per cent, are still well. One must consider, however, that many advanced cases were in this group because too many inoperable cases were subjected to operation. Of 21 cases which had received X-rays only, either before or after operation, six, or 28.5 per cent, are still alive eight years after operation. Three of those patients who died had remained well for six years.

Of 20 cases which were treated by radium more than three years previously, in addition to moderate roentgenotherapy, ten, or 50 per cent, are still alive. (In comparing the percentages of results, one must not forget that the last group is based on three years' observation, while the first and second groups are based on six and eight years', respectively.) It is concluded that although the therapeutic results obtained by roentgen and radium therapy alone are not sufficiently good to warrant one in giving up operation, post-operative irradiation is undoubtedly valuable.

ERNST A. POHLE, M.D., Ph.D.

The Treatment of Cancer of the Lip by Electro-coagulation and Irradiation. George E. Pfahler and Jacob H. Vastine. Jour Am Med Assn, Jan 2, 1932, XCIVIII, 32-36.

The great majority of patients give a history of smoking excessively, many having an associated dry, scaly, or atrophic condition otherwise on the lip. As an additional source of irritation, many of these patients have been exposed much to the sun and wind, being farmers and sea-faring men. These atrophic areas are now destroyed at the beginning, healthy granulation and a well-nourished scar following.

During the last five years biopsies have been done in all cases. When there is any doubt, the lesion is treated as malignant until the microscopic report comes. The general methods of treatment and technic are given in detail.

There has been a recovery of 95.5 per cent in all primary cases, even when there were palpable lymph glands, but only 71 per cent of recoveries in the recurrent cases. Of all types of cases that were treated

radiation therapy two objectives should be sought extinction of actively dividing cells and ultimate inhibition of activity of latent ones

With the above facts in mind, the author believes that pre-operative radiation should be relatively intense, should be delivered in a short period of time, and should include the entire breast and the related lymphatic areas, but should not be of such a character as to damage tissues or interfere with healing of the operative wounds (From ten to thirty days should elapse between cessation of radiation and operation)

Post-operative radiation may ordinarily be commenced three weeks post-operative, the first series of treatments following the principles of pre-operative irradiation, with, however, the intensity of dosage being gradually reduced and the time interval lengthened. This would be given with the thought of destruction of actively dividing cells (which must always be presumed to exist), while the latent tumor cells could be most effectively controlled by divided doses extending over a prolonged period, irradiation being administered widely over various areas of the body

J E HABBE, M D

The Influence of Radio-active Energy upon the Carbohydrate Exchange in Cancerous Disease. A P Kostigova. *Vestnic Röntgenologu i Radiologu*, IX, Nos 2 and 3, p 122

Fifty-one female patients, thirty-three of whom had cancer of the sexual organs, were subjected to radium or roentgen-ray treatment, or both. Before radiation was instituted, the sugar content in the blood was determined and was found to be below normal in most of the cases. After the radiation treatment, the sugar content in the blood was again determined and was found to have declined in those patients who showed improvement in their condition, while in those who showed no improvement the sugar content in the blood was found to be raised

SAMUEL BROWN, M D

A Study of Cancer in Ex-service Men Philip B Matz. *Med. Bull. Veterans Administration*, December, 1931, VII, 1128-1149

The author found in his study of 319 cases of cancer, occurring in ex-service men, that syphilis was associated in only 21 per cent, arthritis in 69 per cent, and diabetes in 19 per cent. It is of interest also that of the 319 cases of malignancy there were 41 patients with co-existing active pulmonary tuberculosis and one with tuberculosis of the dorsal vertebrae.

Among 89 ex-service men who died from cancer, the minimum known duration of the disease was two months, the maximum known duration was 156 months, and the mean known duration was 256 months. Of a group of 203 living ex-service men affected with malignancy, the mean known duration was 45.5 months. The activity of patients with cancer is dependent to a considerable extent upon the site as well as upon the stage of the disease. While, as a general rule, constitutional symptoms of cancer develop in the later stages, it is of common occurrence that in tumors of the digestive tract and of the lymphatic system the activity of the patient is greatly limited in the incipient stages.

A study of the results of treatment correlated with the various regimens used showed that the most effective therapeutic procedures in the order named were Radium, surgery and irradiation, X-ray, surgery, X-ray and radium. Of 315 patients with cancer undergoing hospitalization, 42.8 per cent were considered improved upon the termination of the hospitalization, 20 per cent were unimproved, 5.1 per cent were worse, and 32.1 per cent died during the period of hospitalization. At death the mean age of patients with carcinoma was 47.6 years, and with sarcoma, 42.5 years.

J N ANÉ, M D

Alkaline Reserve in Cases of Uterine Carcinoma after Radiotherapy G de Candia. *L'Actinoter.*, June, 1930, IX, 75-94 (Reprinted from "Cancer Review" by permission.)

From blood examinations made on women with uterine carcinoma, the author finds that, following treatment by radium or X-rays, there is diminution of alkali content. This diminution is progressive from the first to the fifth or sixth day, then it passes off and after about fourteen days the alkali content returns to normal. Apparently, the strength of the dose given bears no relation to the degree of this acidosis.

F CAVERS, D Sc

Clinical Data Concerning the Pre-operative and Post-operative Irradiation of Cancer of the Breast Paul de Backer. *Strahlentherapie*, Nov 14, 1931, XLII, 744-752

During the period from 1919 to 1929, the author observed 109 cases of carcinoma of the breast, which received pre- and post-operative irradiation. In the beginning treatment was given for from fifteen to twenty days before operation and post-operatively as soon as the wound had closed. One or two fields were applied over the tumor area and one or two fields over the anterior and posterior axilla and the suprACLAVICULAR region. Eight cases treated accord-

nence of linear markings of varying degree, which so often are without pathologic significance. A number of sketches are used to illustrate the article, and these serve to make the paper easy to understand by one not yet versed in roentgen pathology of the chest.

I E HABBE, MD

Localization of Pleural Adhesions J V Sparks and Franklin G Wood British Jour Radiol, November, 1931, IV, 592-598

Cases of pulmonary tuberculosis undergoing artificial pneumothorax treatment not infrequently require accurate localization of pleural adhesions which are interfering with the collapse therapy. This can be done in some cases with satisfactory accuracy by routine stereoscopic postero-anterior views (taken by the writers oftentimes, with the patient lying prone and with the tube in a fixed position, while the table is shifted the usual 10 cm distance between exposures of the first and second films). Many times, however, this procedure is not sufficient for certain localizations of the site of attachment of the adhesion on the parietal pleura. In such cases the authors use fluoroscopy to determine the optimum angle for visualization of the adhesion in the right and left oblique positions and then make films in these positions. The nearer the adhesion to the apex the more difficult it is to localize because of the relative shallowness of the thoracic cavity in this region.

I E HABBE, MD

CHEST (THERAPY)

Pneumolysis in Pneumothorax with Adhesions, Report of Five Cases S T Taylor Med Bull Veterans' Administration, December, 1931, VII, 1160, 1161

As a general rule, pneumothorax is successful in direct proportion to the degree of collapse of the diseased area that is obtained. However, in some cases of partial pneumothorax the splinting effect of the thin layer of air and the resulting reduction of mobility act as favorable influences in promoting healing. Practically all unsatisfactory pneumothorax inductions are due to unyielding adhesions which prevent adequate collapse of diseased structures. Extensive surgical procedures would be necessary to convert these chests into satisfactory pneumothorax cases.

The author has adopted the method of cutting these adhesions by means of a thoracoscope and an electric cautery. In his opinion, this procedure is applicable to those cases in which sufficient space exists between the surfaces of the two pleurae, and the adhesions are suitably thinned out.

Five cases with reproductions of roentgenograms are reported. All of these patients had been receiving pneumothorax therapy for six months or more before the pneumolysis operation. The cavities were unclosed and the diseased areas were not immobile. Clinically, the progress of these patients was considered unfavorable. Eight months subsequent to the cutting of the adhesions by means of the thoracoscope and the electric cautery, all the cases in the author's series showed marked improvement, as determined from clinical and roentgenologic examinations.

J N ANÉ, MD

Roentgenographic Appearance of Thorax after Rib Resection for Pulmonary Abscess John T Farrell, Jr Jour Am Med Assn, Dec 26, 1931, XCVII, 1939-1943

This study is based on the post-operative roentgen observations of twenty-three patients. In thirteen, the abscess followed operation, twelve, tonsillectomy, and one hemorrhoidectomy. In nine, it followed an acute respiratory infection, in six, non-specific respiratory infection, and in one, it developed as a sequel to fracture of the mandible. Information is furnished as to the number and portion of ribs resected, the character of the pleural changes, and the post-operative course of the disease. Two types of alteration are seen roentgenographically after rib resection structural and positional. Pleural abnormalities are due either to edematous swelling or to the formation of fluid. The pulmonary changes depend on the site and size of the abscess, on the condition of the pleura, and on the time elapsing after operation.

Abscess associated with pleural disease requires a longer time for complete disappearance of the roentgenographic shadows than uncomplicated abscess. The positional change of the diaphragm after rib resection is directly proportional to the extent of the accompanying pleural changes.

C G SUTHERLAND, MD

DENTAL RADIOGRAPHY

Roentgenography of the Teeth and Alveolar Processes of the Upper Jaw S J Wasbourg Vestnic Rontgenol i Radiol, 1931, IX, 318

The author presents an improved technic for the examination of the teeth and alveolar processes of the upper jaw. This technic consists in placing the film between the upper and lower jaws in a horizontal position, the patient holding it there with his teeth, the mouth of the patient being closed. The

more than five years ago, 85.5 per cent have been cured. This includes the recurrent and metastatic cases

C G SUTHERLAND, M D

CHEST (DIAGNOSIS)

The Subsequent Course of Forty Patients with Acute "Dry" Pleurisy Marshall N Fulton and Richard G Hahn Jour Am Med Assn, Dec. 26, 1931, XCVII, 1959-1961

Pleurisy, with effusion, occurring as a primary illness without demonstrable cause is looked on as tuberculous. That a dry pleurisy is a frequent precursor of pulmonary tuberculosis is well appreciated. The study was undertaken to secure additional information regarding the subsequent course of patients with acute dry pleurisy. Figures in the literature indicate that from 30 to 40 per cent of patients with dry pleurisy eventually manifest pulmonary tuberculosis.

The authors found that tuberculosis had developed in only four of forty patients with acute dry pleurisy in whom no primary cause could be shown and who have been followed from one to sixteen years—on an average of seven years.

While this group is not large, it points strongly to a favorable prognosis in acute dry pleurisy of unknown cause

C G SUTHERLAND, M D

The Radiographic Demonstration of the Vena Azygos W J Mowat British Jour Radiol, December, 1931, IV, 690-692

During a study of the esophagus, with the patient in the right postero-anterior oblique position, the writer accidentally observed a small oval shadow about one-half inch in its longest diameter and of the same density as the aortic shadow. It lay in contact with the right postero-lateral aspect of the esophagus at the level of the fourth or fifth thoracic vertebra. After some study it was decided that this shadow was not due to any pathologic process, but represented the horizontal portion of the vena azygos (the most important collateral channel between the superior and inferior vena cavae), seen on end. This vessel may produce sufficient pressure upon the esophagus to lead to the erroneous diagnosis of spasm of the esophagus, impacted foreign body, or peri-esophageal abscess. Of course, in the presence of thoracic neoplasm, causing pressure on the superior or inferior vena cava, one might hope to demonstrate a dilatation of the vena azygos, hence this anatomic landmark may at times, if abnormal in appearance, yield contributory evidence of pathology elsewhere.

J E HARBE, M D

Silent Pneumonia in Infants G Mouriquand and J Savoye Jour Med de Lyon, Nov 5, 1931, VII, 631-637

This is a discussion of the silent type of pneumonia in infants, including the history, etiology, and clinical and diagnostic study as well as prognosis and evolution. Of the radiologic findings the following is said: "Radioscopy shows a triangular image if the involvement is at the apex, or the right middle lobe. Most frequently, if the base is involved, it cannot be geometrically traced. The diagnosis cannot be completely made without radiological views. The radiological triangle remains the capital symptom. This silent form demonstrates the importance of the X-ray in the examination of infants with pneumonia. Incontestably, radiology alone permits of absolute precision in the study of pneumonia in the infant."

B J DELAUREAL, M D

Unusual Development of the Lower Lobes of the Lung Following Selective Artificial Pneumothorax G Rossel Schweiz med Wochenschr, Aug 22, 1931, LXI, 793-795

A case of tuberculosis of the right upper lobe was treated by selective pneumothorax, producing collapse of the upper lobe. This procedure is based upon the tendency of normal lung tissue to expand and of the areas of infiltration to collapse. In this case a series of roentgenographs demonstrated a gradual expansion of the lower lobes until they occupied almost all of the right side of the chest, the upper lobe remained collapsed.

H C OCHSNER, M D

CHEST (GENERAL)

Radiology of the Chest. An Introduction to the Study of Radiograms of the Chest. E. W Twinning British Jour Radiol, December, 1931, IV, 658-679

This article represents a reprint from the *Manchester University Medical School Gazette* in which journal it was originally published for undergraduate reading. It might well be recommended for reading by any practitioner who doubts the necessity for "special views," for, after describing the more important anatomic landmarks, the author describes some of the special positions necessary in the differentiation of pathologic conditions, particular attention being given to interlobar pleural pathology.

The second part of the article consists of a brief discussion on interpretation of pathologic changes in the lungs and pleura. Particular warning is sounded against over-emphasis of generalized promi-

demonstrated that when the systemic temperature is elevated by radiotherapy, an increased local temperature may be produced and maintained simultaneously in the vagina by applying additional electrical energy in that area. They have employed this mechanism therapeutically in the treatment of pelvic inflammation.

For the systemic elevation of temperature the subject is placed between the plates of a large condenser which forms part of an oscillating circuit. The condenser plates are 50 X 80 cm in dimensions, and are separated from one another by a distance of approximately one meter. The patient rests upon a stretcher between these plates but not in contact with them and is kept covered during the treatment to prevent excessive loss of heat. The frequency commonly used is approximately ten million cycles per second, corresponding to a wave length of 30 meters. With a total D C plate current of 0.5 amperes using radio tubes of appropriate construction, it is possible to produce an elevation of body temperature of about 4 degrees Centigrade in the course of one hour and one-half. With the patient in place between the condenser plates an electrode is placed in the vagina. This electrode is connected, through an ammeter, to a small auxiliary metal plate suspended near one of the large condenser plates of the radiotherm. The electric field produced in the region between the electrode and the condenser plate, opposite the one near which the auxiliary plate is suspended, is considerably higher than it is at any other part of the body. The pick-up plate is usually placed near the condenser plate opposite the affected side. With a pick-up plate of 300 sq cm area, the distance between the pick-up plate and the condenser plate varies from 10 to 30 centimeters. The readings on the radio-frequency ammeter usually vary from one to two amperes.

In a series of fifty cases, it was demonstrated that in the average case the temperature in the vagina was elevated to 42.5°C during a period of fifty-three minutes. At the same time the average rectal temperature rose to 40.5°C, while the average temperature in the mouth rose to 39°C. All temperature readings were made while the current flow was discontinued.

J N ANÉ, M.D.

EXPERIMENTAL STUDIES

Post-operative Atelectasis and Collateral Respiration C. M. Van Allen and T. S. Jung *Jour Thoracic Surg.*, October, 1931, I, 3-14

The pulmonary function of collateral respiration is described as it is seen in dogs. The interlobular septa are incomplete and the alveoli at point of fusion communicate with each other by small openings. The pathogenesis of post-operative atelectasis, as it is

now understood, is explained and experiments are offered to show why collateral respiration and factors reducing its efficiency must be included in the pathogenesis. It was pointed out that the diaphragm is little used by patients who have abdominal operations. This in turn creates deficient aeration in the lung bases, leading to retention of inflammatory secretions and to lobular, bronchial obstruction.

Following animal experimentation, the authors found that, despite marked bronchial obstruction, collateral respiration was surprisingly efficient. A very small section of lung lobe alone proved sufficient to aerate the entire lobe. Blocking by secretions or pneumonic processes in the smaller divisions of the lobe, however, will cause atelectasis, due to blocking of collateral respiration. This is readily applicable to the human lung in cases following abdominal operation.

M M COPELAND, M.D.

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve. Part III—Effect upon the Vascular Nerve (the Irrigating Examination on the Auricle of the Rabbit) S. Suzuki *Japanese Jour Obst and Gynec.*, October, 1931, XIV, 405-409

Following his study of the effects of irradiation on the vegetative nerves, the author studied the effects of X-rays upon the peripheral nerves. One auricle of each of twenty-six rabbits was irradiated and the blood circulatory conditions in the irradiated and control auricles were studied at intervals of one day, two weeks, and four weeks after irradiation. Congestion and dilatation of the capillaries were noted in the irradiated auricles at intervals of from one day to two weeks after irradiation. It was also observed that four weeks after irradiation congestion was still present in the irradiated auricles, although in some cases the irradiated auricles appeared anemic at this time.

The extirpated auricles were studied after the application of adrenalin, pilocarpine, barium, and caffeine. An acceleration of the reaction of the blood vessels to drugs producing vascular dilatation and contraction was observed in the irradiated auricles. It is believed that the early results were due to the changes produced in the vegetative nerves of the blood vessels by irradiation. Later on, as a result of irradiation, changes occurred also in the smooth muscles of the blood vessels.

J N ANÉ, M.D.

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve. Part IV—Histologic Investigation of the Effect of the Irradiation of the Inferior Mesenteric Ganglion on

central ray is directed toward the first molar at an angle of 45 degrees

The advantages of this method are as follows
(1) The film can be held even in the absence of teeth, (2) the avoidance of introducing the finger into the mouth, (3) the possibility of holding a film in the mouth which cannot be opened widely, and, (4) the use of larger films enables one to obtain a larger area of the alveolar process and a larger number of teeth at one sitting

SAMUEL BROWN, M.D.

DIAPHRAGMATIC HERNIA

The Diagnosis and Treatment of Diaphragmatic Hernia Stuart W Harrington Jour Thoracic Surg, October, 1931, I, 24-40

The author points out the difficulty in diagnosing diaphragmatic hernia, which often simulates the symptoms associated with cholecystitis, gastric ulcer, cardiospasm, intestinal obstruction, and angina pectoris. The symptoms depend on the following: (1) Mechanical interference with the function of the herniated abdominal viscera, (2) interference with the function of the diaphragm, (3) amount of increased pressure within the thorax. The embryology of the diaphragm is discussed because its rôle in occasionally failing to completely fuse allows herniation.

Diaphragmatic hernia has been classified as follows: (1) Congenital, (2) acquired, and (3) traumatic. The author suggests the following classification: (1) Congenital, and (2) acquired after birth. The most common sites are through the hiatus pleuroperitonealis, through the dome of the diaphragm, through the esophageal opening, through the foramen Morgagni, and through the gap left by absence of the left half of the diaphragm.

Leading symptoms may at first be mild epigastric distress with belching. The pain may gradually become more severe, dyspnea with nausea and vomiting supervening with relief. Recurrent attacks are frequent.

Roentgenologic examination of the stomach is important in establishing a definite diagnosis. The clinical and operative observations are based on 45 cases of diaphragmatic hernia on which the author has operated in the past five years. Operative replacement of the herniated viscera into the abdomen and repair of the abdominal opening in the diaphragm is the only treatment which insures complete relief of symptoms. Palliative phrenicotomy has been used in selected cases in which operation was contra-indicated. Phrenicotomy as a preliminary procedure is often of value in repair of the hernial openings. Radical operation was performed in 38 cases. There were five operative deaths and no recurrences.

M. M. COPELAND, M.D.

Hernia or Eventration of the Diaphragm Report of a Case Carl Eggers Jour Thoracic Surg, October, 1931, I, 41-49

A case is presented to illustrate the difficulties of correct diagnosis. The patient was a female infant, four weeks old. At birth the child seemed normal, but with each feeding (breast) she became cyanotic and dyspneic. Examination revealed lack of movement of the left chest. The heart was displaced to the right, breath sounds being absent over the left lower chest.

A fluoroscopic examination was made and X-ray films were made. They showed the heart in the right thorax, the esophagus angulated at the cardia, and the stomach in the left thorax. Other X-ray plates made later showed that a portion of the colon was situated in the hernia.

W. H. Stewart felt that the case was one of eventration, basing his diagnosis on the presence of what he thought to be a high diaphragm, which was seen in the X-ray plates. Surgical consultation expressed itself in favor of hernia, for the reason that only hernia produces such severe symptoms and causes retention of bismuth for more than six hours. Operation was decided upon. At exploration the mass was thought to be a diaphragmatic hernia. All of its contents were reduced save for the liver, however, the patient died after fourteen hours.

A whitish structure, which was pulled into view during operation and thought to be the esophagus, was found to be a stretched-out central tendon of the diaphragm when a postmortem abdominal examination was done. The diagnosis of eventration of the diaphragm was then established.

A short discussion follows the report of the case. Eventration of the diaphragm is considered comparatively rare. The congenital form is said to be due to failure of development of the muscle elements of the phrenic nerve. The acquired type is occasionally seen as a complication of an acute infectious disease (toxic action on the nerve). The treatment of a similar case would be surgical repair.

M. M. COPELAND, M.D.

DIATHERMY

General Hyperthermia with Heat Localization by Radiotherapy William Bierman and Myron Schwarzschild Proc Soc Exp Biol and Med January, 1932 XXIX, 439-441

When heat is applied locally to any region of the body, it is rapidly dispersed, rendering it difficult to secure any substantial elevation of temperature in that region. In the live, anesthetized dog placed in the field of a high frequency current, the different organs heat up at approximately the same rate, the blood serving as a very efficient distributing mechanism of the generated heat. The authors

demonstrated that when the systemic temperature is elevated by radiotherapy, an increased local temperature may be produced and maintained simultaneously in the vagina by applying additional electrical energy in that area. They have employed this mechanism therapeutically in the treatment of pelvic inflammation.

For the systemic elevation of temperature the subject is placed between the plates of a large condenser which forms part of an oscillating circuit. The condenser plates are 50 X 80 cm. in dimensions, and are separated from one another by a distance of approximately one meter. The patient rests upon a stretcher between these plates but not in contact with them and is kept covered during the treatment to prevent excessive loss of heat. The frequency commonly used is approximately ten million cycles per second, corresponding to a wave length of 30 meters. With a total D C plate current of 0.5 amperes using radio tubes of appropriate construction, it is possible to produce an elevation of body temperature of about 4 degrees Centigrade in the course of one hour and one-half. With the patient in place between the condenser plates an electrode is placed in the vagina. This electrode is connected, through an ammeter, to a small auxiliary metal plate suspended near one of the large condenser plates of the radiotherm. The electric field produced in the region between the electrode and the condenser plate, opposite the one near which the auxiliary plate is suspended, is considerably higher than it is at any other part of the body. The pick-up plate is usually placed near the condenser plate opposite the affected side. With a pick-up plate of 300 sq cm area, the distance between the pick-up plate and the condenser plate varies from 10 to 30 centimeters. The readings on the radio-frequency ammeter usually vary from one to two amperes.

In a series of fifty cases, it was demonstrated that in the average case the temperature in the vagina was elevated to 42.5°C during a period of fifty-three minutes. At the same time the average rectal temperature rose to 40.5°C, while the average temperature in the mouth rose to 39°C. All temperature readings were made while the current flow was discontinued.

T N ANE, M D

EXPERIMENTAL STUDIES

Post-operative Atelectasis and Collateral Respiration. C. M. Van Allen and T. S. Jung. *Jour Thoracic Surg*, October, 1931, I, 3-14.

The pulmonary function of collateral respiration is described as it is seen in dogs. The interlobular septa are incomplete and the alveoli at point of fusion communicate with each other by small openings. The pathogenesis of post-operative atelectasis, as it is

now understood, is explained and experiments are offered to show why collateral respiration and factors reducing its efficiency must be included in the pathogenesis. It was pointed out that the diaphragm is little used by patients who have abdominal operations. This in turn creates deficient aeration in the lung bases, leading to retention of inflammatory secretions and to lobular, bronchial obstruction.

Following animal experimentation, the authors found that, despite marked bronchial obstruction, collateral respiration was surprisingly efficient. A very small section of lung lobe alone proved sufficient to aerate the entire lobe. Blocking by secretions or pneumonic processes in the smaller divisions of the lobe, however, will cause atelectasis, due to blocking of collateral respiration. This is readily applicable to the human lung in cases following abdominal operation.

M M COPELAND, M D

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve Part III—Effect upon the Vascular Nerve (the Irrigating Examination on the Auricle of the Rabbit). S Suzuki. *Japanese Jour Obst and Gynec*, October, 1931, XIV, 405-409.

Following his study of the effects of irradiation on the vegetative nerves, the author studied the effects of X-rays upon the peripheral nerves. One auricle of each of twenty-six rabbits was irradiated and the blood circulatory conditions in the irradiated and control auricles were studied at intervals of one day, two weeks, and four weeks after irradiation. Congestion and dilatation of the capillaries were noted in the irradiated auricles at intervals of from one day to two weeks after irradiation. It was also observed that four weeks after irradiation congestion was still present in the irradiated auricles, although in some cases the irradiated auricles appeared anemic at this time.

The extirpated auricles were studied after the application of adrenalin, pilocarpine, barium, and caffeine. An acceleration of the reaction of the blood vessels to drugs producing vascular dilatation and contraction was observed in the irradiated auricles. It is believed that the early results were due to the changes produced in the vegetative nerves of the blood vessels by irradiation. Later on, as a result of irradiation, changes occurred also in the smooth muscles of the blood vessels.

J N ANE, M D

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve. Part IV—Histologic Investigation of the Effect of the Irradiation of the Inferior Mesenteric Ganglion on

the Female Genitals S Suzuki Japanese Jour Obst and Gynec, October, 1931, XIV, 410-415

The author studied the histologic changes produced in the inferior mesenteric ganglion as a result of roentgen irradiation and also observed the secondary changes which occurred in the female genital organs. Female mature rabbits were employed as experimental animals and at intervals of from one to thirty days after irradiation the inferior mesenteric ganglion and the genital organs were extirpated, the specimens being stained with hematoxylin and eosin.

Thirty days following irradiation, examination of the stained specimen revealed atrophy of the cells of the ganglion. The cells of the ganglion were irregular and the nuclei were darkly stained and atrophied, showing no evidence of the nucleoli. Some of the cells contained small or large vacuoles, with a disappearance of the granules. The changes noted in the blood vessels and lymphatics were very slight. When the ganglion was examined from nine to twenty-one days after irradiation, the changes observed were considered very slight when compared to those observed after thirty days.

The author observed in those cases examined from four weeks to fifty days after irradiation that there occurred an acceleration in development in the female genital organs, these changes being noted to be somewhat marked in the ovaries in particular. The author is of the opinion that irradiation of the inferior mesenteric ganglion produces atrophy and degeneration of the cells of the ganglion, resulting in loss of control of the sympathetic nerves which act as vasomotor nerves in the blood vessels of the peripheral organs. This is in agreement with the previous work of the author, in which it was demonstrated that any disturbance in the ganglion produces a hyperfunction in the peripheral organs supplied by the ganglionic nerves.

J N AVE, MD

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve Part V—Clinical Observation S Suzuki Japanese Jour Obst and Gynec., October, 1931, XIV, 416-420

In previous experimental work the author demonstrated that the X-ray produces a hypertonia of the parasympathetic nervous system, as shown by the blood-pressure curves of rabbits following irradiation. In this experiment, cases of inoperable uterine cancer were selected for the study. Blood-pressure determinations were made after the patient became quiet following irradiation and again after the subcutaneous injection of 0.7 c.c. of 1-1000 solution of adrenalin chloride. The blood pressure, pulsation, respiration, and other effects were

fully studied, at approximately five-minute intervals, for a period of sixty minutes following the injection.

It was observed that a definite fall in both the systolic and diastolic blood pressure readings occurred immediately following irradiation. In the majority of cases this fall was below 4 mm Hg, and in the next largest group the fall was from 5 to 9 mm Hg. However, it is of interest to note that after the sixth treatment some of the cases showed a rise in blood pressure. Subsequent to irradiation the usual rise in blood pressure following the injection of adrenalin was decreased. The palpitation, cyanosis, and other effects of adrenalin were slight or not evident in the irradiated cases. The author concludes that these changes resulted from the parasympathicotonia caused by radiation.

J N AVE, MD

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Radiologic Diagnosis of Diverticulosis of the Colon. H Béclère and P Porcher Jour d Radiol et de l'Electrol, July, 1930, XIV, 380-390

A means of making a differential diagnosis between various types of diverticulosis of the colon is presented with radiographic evidence. Three types are distinguished as follows: False diverticula, formed only by folds of the mucosa; true diverticula, and those formed by a septum, due to perivisceral conditions.

True diverticula occur most frequently in the sigmoid or left colon, are seldom single, and never exceed the apparent volume of a large pea; they are usually asymmetrical, best seen by opaque enemas, and persist after evacuation of the segment. No modification of peristalsis occurs, but occasionally spasm is seen when they are the seat of inflammation.

False diverticula of the mucosa are seen in all parts of the colon, except the sigmoid, and are variable in number. The volume varies with the peristaltic rhythm (large in the ascending colon, in which long, strong contractions occur, smaller in the left transverse part, in which contractions are more rapid); they are never seen by an opaque enema but always following an opaque meal. After evacuation of the segment they disappear and cause no modification of the peristaltic waves.

Diverticula formed by a septum are seen especially at the level of the hepatic angle and the external border of the right and the superior border of the right transverse colon. The number is very variable and the volume can be enormous, depending on the adhesions. They can be visualized by either

method, the general contour is not preserved after evacuation, and the peristalsis is modified on the face involved

The most common error is to mistake a normal fold of the colon for a diverticulum. Although after complete evacuation of the colon the true diverticulum can be identified, it is usually very difficult, with a barium meal, to differentiate between a false and a true one. Recourse to a barium enema, preceded or not by an antispasmodic, is indicated whenever possible. The distention created by the enema permits individualization of these diverticula with much less chance of error. When infected, diverticula are seen, spasm occurs, which resists the action of belladonna and enema. The contour of the colon can become plaited (accordion-like), as in colitis, the peristaltic contractions are less deep, but closer. The segment is comparatively empty and non-expansile.

B J DELAUREAL, M D

Roentgenography of the Normal Relief of the Mucous Membrane of the Stomach and the Technic of Its Investigation V A. Fanardjev *Vestnic Röntgenol i Radiol*, 1931, IX, 270

The relief of the mucous membrane of the stomach is studied after the introduction of a small amount of thick barium mixture. Roentgenograms are taken with the patient in the erect and recumbent positions, at various degrees of pressure. In normal cases the internal relief of the body of the stomach is characterized by four longitudinal folds which are parallel to each other. In the pyloric region the course of the folds varies considerably. They may be longitudinal, oblique, or even transverse. The width of the folds and their intervals vary from 0.5 to 0.6 cm under normal conditions. The paper is illustrated by a number of figures.

SAMUEL BROWN, M D

Radiologic Examination of Non-surgical Conservative Disinvagination of Acute Invagination in Children Jacob Nordentoft *Tour Rad et d'électrol*, July, 1930, XIV, 369-379

Most surgeons are skeptical of this method chiefly because of the uncertainty of the return of the intestine to its normal position, until the first spontaneous stool occurs. The Swedish doctors, Yngve Olson and Gustav Pöllin, and, later, Arntzen and the author proposed this maneuver under X-ray guidance, following a barium lavage. This was done in 108 cases. Fifty-six gave perfect results, and four cases were unsuccessful. Three of these had ileocecal invaginations, another a colo-cecal affair. Of the

54 cases operated on, only one died, the rest were cured. Practically all had repeated lavages under increasing pressures. Eleven case histories are presented with accompanying radiologic illustrations.

The author has found the same radiologic evidence presented by Brocq and Guellette, that is, arrest of a column of barium following a regular concave line, moulding with a clear convex zone, and carrying at times in its axis an obscure defile, more or less sinuous—the effects of abnormal shortening of a colonic segment.

He believes that if the X-ray study does not show the typical form of colocolic or ileo-cecal colic invagination with concave limitation of the barium column in some part of the colon, but bizarre forms, the attempt at non-surgical relief should be abandoned. Again, in ileo-cecal invaginations surgical intervention should be done without delay. X-ray studies are easy and rapid and prevent loss of time in attempts at reduction when operations are indicated.

He concludes that radiologic examination will become an aid of certain importance in the diagnosis and therapy of this disease. When non-surgical reduction is done, the success and progress can be observed and the hours of doubt and suspense relieved while waiting for the appearance of normal stools three days later.

B J DELAUREAL, M D

Interposition of the Large Bowel between the Liver and the Diaphragm M Z Rotenfeld *Vestnic Röntgenologu i Radiologu*, IX, Nos 2 and 3, p 153

The diagnosis of interposition of the large bowel between the liver and diaphragm depends upon roentgenologic investigation of the gastro-intestinal tract. There is no symptom-complex which would lead the clinician to suspect its presence. The only characteristic and pathognomonic sign of this condition is the roentgenologic demonstration of the large bowel between the diaphragm and liver. The author believes that ptosis of the liver may have something to do with this anomaly. In general, it is found but rarely and is of very little clinical significance.

SAMUEL BROWN, M D

Interposition of the Colon between the Liver and Diaphragm J Tremolieres and Andre Tardieu *Arch d mal de l'app digestif*, December, 1931, VII, 1154-1198

Often these conditions are looked upon as constituting a harmless abnormality or as due to flatulence, but after the authors had studied 19 such cases in one year, they were confirmed in their first observa-

tions, namely, that this condition results from perivisceral adhesions. The authors have reported certain pathologic findings and diagnostic peculiarities, which clear up the symptomatic significance.

In a radiologic study of this anomaly, following its suspicion from percussion, one notices below the diaphragmatic spherical vault, in the middle of the hepatic shadow, a region of lesser density, and, outside of this area, a clear area of variable extent which may be as large as the hand, uniform or streaked by a fold of the colon.

An opaque substance ingested from seven to ten hours before examination reveals the right half of the colon, or the barium enema finds its way into the clear pocket outside of, or in front of, the liver.

Usually the hepatic flexure is found between the anterior surfaces of the liver and diaphragm, rarely between the liver and the axilla. Occasionally the shadow is that of a very long sigmoid colon or possibly the cecum. It is not always permanent and may disappear upon the patient's changing position. It is more apt to be present when the patient is in the erect posture, and the weight of food or barium may displace it below the liver.

Besides the various etiologic factors brought out by different authors, such as change in abdominal pressure, diminished volume of the liver as a result of disease or change in the ligaments, adhesions as a result of appendicitis, gall-bladder disease, gastric ulcers, inflammation of the cecum, and any other condition that may produce peritoneal irritation must be added. This has been proven by cases upon which operation has been done; three showed the presence of ulcers, new or old, 10, chronic appendicitis, four, chronic colitis of obscure origin, in some cases complicated by chronic cholecystitis, one evidenced cholecystitis alone. All showed adhesive perivisceritis. Pericolitis appears to be an element common to these various conditions, and it is primary or secondary to the subhepatic region. The colon is then necessarily adhesive to the liver, the flatulence forcing its interposition.

Treatment consists of hot applications to the abdomen, antispasmodics as bromides and valerian, mixed vaccines, bismuth, kaolin, charcoal, and other treatments of colitis and limitation of fermentative hydrocarbons. Heliotherapy, ultra-violet and infrared rays, and diathermy may be tried for the perivisceritis. Massage and gymnastics may help. If no relief is obtained, resort may be had to surgery.

B J DELAUREAL MD

GENITO-URINARY TRACT (DIAGNOSIS)

Hydronephrosis James Christiansen Med Bull Veterans' Administration, December 1931 VII 1162-1164

Complete obstruction of the urinary tract usually results in the cessation of secretion of urine by the kidney on the involved side, before the pelvis is dilated. However, intermittent or partial obstruction results in dilatation of the kidney pelvis. This dilatation may continue until the kidney tissue is completely destroyed so that only a thin wall of cortex may remain as a lining of the hydronephrotic sac. Obstruction of the urinary tract may result from the following causes: Inflammatory strictures, enlargement of the prostate or seminal vesicles, urinary calculi, angulation or kink of the ureter, and reflux from the bladder.

Hydronephrosis usually causes pain of a colicky character, and on physical examination tenderness and a palpable tumor may be found. Cystoscopic and roentgenologic examinations are valuable aids in establishing the diagnosis. The pyelogram will show the enlarged pelvis and will determine the size of the hydronephrotic sac.

The treatment of this condition consists of the removal of the obstruction and emptying of the pelvis. In those cases in which total destruction of the kidney pelvis has occurred nephrectomy is advisable.

The author reports a series of cases and discusses the diagnostic and therapeutic methods employed.

J N AVE, MD

GENITO-URINARY TRACT (THERAPY)

The Relation of Cystocele to the Upper Urinary Tract. Jefferson C. Pennington Urol and Cutan Rev, January, 1932, XXXVI, 1-8.

The author discusses the importance of the association of cystocele and lesions of the upper urinary tract, and urges the closest co-operation of the gynecologist and urologist in the treatment of these cases. While the causes of cystocele are very numerous, it is believed that most frequently it results from trauma and perineal lacerations following childbirth. Congenital tissue weakness, senility, uterine tumors, and general abdominal ptosis are other etiologic factors. The prominent symptoms are those due to vesical irritability.

Cystocele when far advanced is very easily recognized. Cases of lesser degree may escape detection if only casual inspection is resorted to. Cystoscopy is found a valuable aid in many cases. Employing the technic of H G Pretty, X-rays have been found serviceable in these cases. A 10 per cent solution of sodium iodide is injected into the bladder, while the patient is lying on her back on the table. She is then placed in the vertical position

and the X-ray tube centered over the symphysis pubis. The roentgenogram is taken while the patient is in the act of "bearing down."

Cystoceles do occur without associated pathology, and, in the opinion of the author, they should be severe enough to interfere with bladder function before they require especial attention. A cystocele with retention of urine is analogous to retention of urine in the male caused by prostatic obstruction. Cystitis follows as a result of retention of urine, and the infection spreads by direct continuity through the blood stream and lymph channels to the ureters and pelvis of the kidneys.

Cystocele is very frequently associated with rectocele, which, in turn, results in intestinal stasis. The lymphatic systems of intestines and kidneys have been shown to be closely associated and this serves as a route of infecting organisms. It is also known that colon bacilli in passing through the kidneys will frequently attack the kidneys if for some reason the patient's general resistance has been lowered. As a result, the patient may have a pyelitis, nephroptosis, and rectocele associated with the cystocele.

The author is of the opinion that these patients should be examined carefully and thoroughly, so that rational and beneficial therapeutic methods may be planned.

J. N. ANE, M.D.

Radiation Therapy of Malignancies of the Bladder and Prostate. Ira I. Kaplan. Urol and Cutan Rev, January, 1932, XXXVI, 40-42.

It is generally agreed that, as in malignancy situated elsewhere, the best treatment for early lesions of the bladder and prostate is surgery, followed by irradiation. Unfortunately, however, the disease is surely well advanced in the average case before the diagnosis of malignancy is made. Radiation therapy of these organs requires as careful and thorough a technic as the surgical form of therapy.

Radiation therapy in genito-urinary work advanced with the advent of the manufacture of glass tubules of radium gas by Dominicci. While the results obtained at first were found encouraging, it was observed that marked necrosis of all tissues followed the application of these tubules. The metal filtered tubules were found very much more satisfactory, as the metal filtered off to a large extent the corrosive rays of the radium emanation and produced a much more efficient gamma effect on the irradiated tissues.

Regaud reaffirmed the axiom that the best form of radium therapy is that produced by applying to the lesion a small quantity of radium properly filtered,

over a long period of time. Utilizing this theory, there has been devised a method of treating cancer of the cervix uteri, which has replaced operative procedures for this condition in most of the clinics here and abroad. This technic replaced the older intratumoral puncture method in the treatment of cancer of the rectum and cervix in the author's service. The results were so favorable in these cases that he next devised a technic for the application of this form of irradiation to malignancies of the bladder and prostate.

In the case of cancer of the bladder, after a preliminary suprapubic cystotomy, a stay suture is placed in the bladder wall in close proximity to, and on either side of, the lesion. This suture is so inserted as to leave a loose loop between needle holes in the cavity, and the ends of the sutures are brought out in the suprapubic opening. The radium tube is then placed in a rubber tube which is tied at both ends with the long ends of the thread remaining. The radium tube is then placed in position about the lesion to be treated. The long threads from the tube are carried under the loop of the stay sutures on either side of the lesion, brought out through the suprapubic opening, and anchored on the abdominal wall by adhesive tape. From one to four tubes are used about the periphery of the lesion. The dosage employed depends upon the size of the lesion and varies from 2,000 to 5,000 milligram-hours. The tubes, containing from 5 to 15 milligrams of radium or radon, are filtered through from 1 to 15 millimeter thickness. The bladder is irrigated daily with boric acid solution.

At the conclusion of the treatment one end of the stay suture is cut close to the suprapubic orifice and traction applied to the other end, the stay suture being withdrawn from the bladder. The other suture is released in the same manner and the radium tube is drawn through the suprapubic opening.

Radium therapy is applied to the prostate by exposing the prostate through the usual perineal incision. The levator muscles are separated and the urethra and rectum separated from the prostatic capsule by blunt dissection. Then holes are made through the capsule and extended into the gland proper by means of a large curved artery forceps. After the radium tubes are pushed into these holes, the wound is packed with iodoform gauze, and closed in the usual manner, leaving a skin opening at one side from which the ends of the tube threads and the iodoform gauze protrude. From 5 to 15 milligrams of radium are used in each tube and a total dose of from 200 to 500 milligram-hours is given. In cases in which symptoms of urinary obstruction are present, a suprapubic cystotomy is done for bladder drainage before radiation treatment is given. This wound can usually be closed after radium treatment.

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J. N. ANI, M.D.

GYNECOLOGY AND OBSTETRICS

The Pre-operative Irradiation of Uterine Carcinoma. A Mayer Strahlentherapie, Nov 14, 1931, XLII, 759-768

During the period from July, 1926, to October, 1931, the author observed 91 cases of uterine carcinoma irradiated before operation. From 1927 to 1929, there was no operative death and the total mortality in five years amounted to only four, or 4.3 per cent. Two of these cases died from cachexia, one from heart disease, and only one after operation, from peritonitis. Roentgen rays and radium were used in combination, or radium alone. No definite information as to the radiosensitivity of the tumor could be obtained either from the clinical picture or from the histologic study of a section. It also appeared that temporary clinical cure and permanent or anatomic cure do not always run parallel. Of 101 women who were operated on, three months after irradiation the carcinoma had disappeared from the surface in 56 cases, while in only 20 of these microscopic examination of the removed uterus revealed no cancer tissue. No definite statistical figures as to five-year cures can be given at the present time.

The author concludes that undoubtedly pre-operative irradiation improves the chances for operation. It helps in rendering the operative area aseptic and decreases, therefore, the percentage of post-operative peritonitis. As a preliminary figure of cures, he gives 41.3 per cent for pre-operative irradiation and operation, as compared with 31 per cent for operation alone.

ERNST A. POHLE, M.D., Ph.D.

The Influence of the Irradiation of the Hypophysis upon the Female Genitals S. Suzuki Japanese Jour Obst and Gynec, October, 1931 XIV, 393-399

The relationship of the hypophysis to other endocrine organs has been proved by many investigators. Long and Evans, and later Aschheim and Zondek demonstrated the effect of the pituitary hormone upon the genitals. The author studied the secondary effects upon the female genital organs caused by irradiation of the hypophysis. Albino rats were chosen as experimental animals and immobilized so that only the heads of the rats were irradiated. The factors employed were as follows: Effective voltage, 159 K.V., 2 ma., skin focal distance, 23 cm., filtration, 1 mm Al plus 0.5 mm Zn, the shortest wave length, 0.09-0.095 A.E.

The rats were divided into three groups and designated as A, B, and C. A group was irradiated for a period of twenty minutes, seven or eight times at intervals of from one to five days. B

group received three irradiations of forty-five minutes each at intervals of from two to seven days. C group was irradiated three times at intervals of one or two days for a period of sixty minutes, each time. From 137 to 166 days were required for the experiment.

Immature rats were also employed and divided into three groups, these groups receiving ten, fifteen, and twenty minutes' irradiation, respectively. These animals received eight treatments, for at the onset of estrus the irradiation was discontinued and changes in the body weight and sexual cycle observed. This study lasted 166 days.

Of the five cases irradiated eight times for a period of twenty minutes each time, two cases showed a lengthening of the sexual cycle, and in the remaining three cases the change was not so marked. Of the five cases irradiated three times for a period of forty-five minutes each treatment, a definite change and lengthening of the sexual periodicity occurred, no change occurring in the other two cases. Of five cases irradiated for a period of sixty minutes from four to six times, four revealed a longer interval and one case showed no change. While the immature rats, which had been irradiated from fifteen to twenty minutes, revealed a marked decrease in rate of growth, none of the animals showed any change in the onset of estrus as compared with normal controls.

The author concludes that secondary changes do occur in the ovaries, as a result of irradiation of the hypophysis. He further believes that the results obtained in the irradiated immature rats prove the existence of a hormone accelerating the bodily development in the hypophysis.

Using identical material and methods of irradiation, the author studied also the effects of adrenalin, pilocarpine, and barium on the uterine movement of the irradiated and normal control animals. It was observed that the extirpated uterus of the irradiated rat demonstrated a decrease in sensibility to adrenalin and barium. However, in some cases the reverse effects were noted following the use of adrenalin. Very little or no decrease in sensibility to pilocarpine was noted.

The author is of the opinion that irradiation of the hypophysis produces an atrophy and consequent hypofunction in this organ which results in a secondary atrophy of the genital organs and decrease in sensibility to the usual uterine stimulants.

J. N. ANÉ, M.D.

THE JOINTS

Synovial Fluid. Editorial Jour Am Med Assn, Dec. 26, 1931, XCVII, 1969

The composition of the synovia is not constant but differs in rest and motion of the joint.

There is a notable distinction between the fluid and blood plasma or ordinary lymph, presumably due to a mucin-like substance in the synovia. The exact nature of the mucinous constituent remains unknown.

Fremont-Smith and Dailey concluded that the equilibrium between plasma and synovial fluid is of the same nature as that between plasma and peritoneal or pleural effusions. Kling found the viscosity of normal, and the majority of pathologic, synovial fluids to be higher and the range of variation greater than that found in plasma and exudates. The mucinous substance is recognized to be a physiologic product. Inflammation and irritation tend to increase its output. Kling believes the structure and function of the synovial membrane are twofold, one part being for mechanical binding of the epiphyses and the other for maintenance of smooth motion and lubrication. The secretory element is best developed in the knee joint and less well developed in the wrist and tarsal joints. Motion is the natural stimulus for the secretion of synovia, as is food for the secretion of gastric juices. The detrimental effect of immobilization, especially in knee joints, is therefore explained by the interference with this secretion in a joint highly adapted to it.

C G SUTHERLAND, M D

Patella Partita Werner Feistkorn Röntgenpraxis, Oct 15, 1931, III, 945-951

The differentiation of a patella partita from a fracture of the patella is not always easy. Comparison of the affected knee with the other knee is very important, if one wants to avoid mistakes, which are especially disagreeable in insurance cases. In the majority of cases, this anomaly is found bilateral.

The case described showed multiple separate portions of the patella. The pathogenesis of the patella partita is not yet clear. Some authors think of a congenital deformity caused by separate centers of ossification, while others consider an osteochondritic lesion (with "Umbrozonen") similar to Osgood-Schlatter's disease. A slight trauma and excessive muscle traction might be factors. In the case described no fracture could be shown, except a very small fragment. However, many months afterwards the picture of a patella multipartita appeared. Both knees showed several centers of ossification.

H W HEEKE, M D

LEAD POISONING

Röntgenologic Diagnosis of Lead Poisoning in Infants and Children Edward C Vogt Jour Am Med Assn Jan 9, 1932 XCVIII, 125-129

Since August 1929, thirty-two cases have been

diagnosed in his clinic. Quite a number were detected in the roentgenograms before otherwise suspected. The most frequent source is from paint off furniture, woodwork, and toys. Symptoms occur most commonly between the ages of one and two years, and are chiefly neurologic and gastro-intestinal. A secondary anemia is usual. Basophilic stippling of the red blood cells is considered one of the most reliable observations. The lead line in the gums is seldom seen in children.

A roentgenologic sign is a dense band at the growing margins of all bones, being most evident at the ends of the long bones and anterior ends of the ribs. It must be differentiated from rapidly healing or recently healed rickets, or changes following severe nutritional disturbances with retarded growth of bone.

C G SUTHERLAND, M D

RADIATION

Fluctuations of the Lactic Acid Content of the Blood Following Roentgen Exposures of Normal and Pathologic Body Tissues J Heeren and R. Hummel Strahlentherapie, Nov 14, 1931, XLII, 784-792

In a series of patients who received X-ray deep therapy the lactic acid content of the blood was determined. It appeared that if normal tissues of patients who had no malignancy were irradiated, there was no increase of the lactic acid content in the blood, no patients showed a decrease immediately following irradiation. Patients with malignant neoplasm responded as a rule with an increase in the lactic acid content of the blood immediately after irradiation. If they were treated over normal tissues, as, for instance, over the thigh on another occasion, the lactic acid content of the blood was found decreased immediately after irradiation. The irradiation of tuberculous or other pathologic tissue, with the exception of neoplasm, also brings about a decrease of the lactic acid content of the blood. This change is usually of short duration, two hours after irradiation it may have already disappeared.

ERNST A POHLE, M D, Ph D

Sources of Radiation and Their Physical Characteristics W W Coblenz Jour Am Med Assn, Dec 26, 1931, XCVII, 1965-1967

Recent additions to the physical therapist's armamentarium are the so-called cold red ray and cold quartz ultra-violet ray lamps. The term "cold ray" is a misnomer. Thermal radiation of all wave lengths (whether ultra-violet, visible, or infra-red rays), when absorbed, produces heat. The reason these two

sources do not have a sensible heating effect and the burners do not become highly heated is that very little electric power is put into the lamps and little radiant power is emitted

A description of the light and comparison of units are given

He comments on the difference in the physiologic action of ultra-violet rays of wave lengths less than 265 millimicrons in artificial sources and those from 310 to 315 millimicrons, which are very intense in sunlight. It will require a long time to inform the public of the importance of timing the sunbath to avoid severe burns. Many painful burns could be avoided by warning

C. G. SUTHERLAND, M.D.

ROENTGEN-RAY (INDUSTRIAL APPLICATION)

Practical Application of X-ray Diffraction Methods in the Study of Quench and Temper Structures of Carbon Spring Steels N P Goss Trans Am Soc. Steel Treating, 1931, XIX, 182-192.

X-ray diffraction methods show that quenching and temper structures are quite independent of each other. The ill effects of improper quenching cannot be removed by tempering, which only facilitates the precipitation of Fe,C, the α -Fe matrix is not changed. X-rays will determine whether the proper quench structure was obtained, even though the steel has been tempered. Diffraction patterns are given

CHEMICAL ABSTRACTS

Radiography by the Use of Gamma Rays Robert F. Mehl, Gilbert E. Doan, and Charles S. Barrett. Trans Am Soc. Steel Treating, 1930, XVIII, 1192-1227, Jour Inst. Metals, 1931, XLIV, 606

A preliminary paper on the examination of metals by γ -rays from radio-active substances. Radiographs were obtained of steel, the thickness of which far exceeds that possible for X-rays. Ten inches of steel has been penetrated with slight success. Three methods were used (a) Ionizing effects of the γ -ray, (b) fluorescent screen, and (c) photographic film. The last gave best results. Exposures of one hour per inch of thickness of steel, with 18 inches photo-distance source to film, gave good results. Photographs are given

CHEMICAL ABSTRACTS

THE SINUSES (DIAGNOSIS)

The Relation of the Sphenoid Sinus to Dysfunction of the Pituitary Gland S. Bockoven Med Bull Veterans' Administration, January, 1932, VIII, 43, 44

Anatomically, the pituitary gland is separated from the sphenoid sinuses by only a thin layer of bone. The optic chiasm is situated almost immediately in front of the pituitary, which accounts for the findings in the eye grounds which are sometimes observed in posterior sinus disease. In like manner, pathologic changes in the optic tract in some cases result from disease of the sphenoid sinuses.

The author emphasizes the necessity of a complete and careful study of the sphenoid sinuses in all cases of pituitary dysfunction, such as is found in diabetes insipidus. He cites the case of an ex-service man who was admitted to the hospital because of polyuria, nocturia, and a disturbance in vision. A careful examination of his sinuses, including lipiodol injection and roentgen examination, revealed definite evidence of sphenoid disease. The sphenoid sinuses were treated, and the patient experienced considerable relief of his symptoms.

The author is of the opinion that further study along these lines may reveal other evidence of disturbance in the function of this gland, due to irritation in this region, secondary to definite disease of the sphenoid sinuses.

J. N. ANE, M.D.

THE SKIN (GENERAL)

Acne A Statistical Study of Possible Related Causes Ruby L. Cunningham and C. J. Lunsford Calif and West Med, July, 1931, XXXV, 22-26

In this study of acne the authors have used young women students entering the University of California. The physical examination showed acne in 23.7 per cent, or 2,974 students. They selected 3,185 students out of those without acne to represent a control group. They compared the weight of these groups as to overweight and underweight. Very little difference in percentage was found in the two groups, namely, "acne present" and "acne not present." Again, a comparison, using the complexion, showed very little difference. Using the menstrual history, the difference was found to be very small.

Regarding infections, such as boils, appendicitis, tuberculosis, tonsillitis, constipation, headache, etc., one is again struck by the similarity of percentages in the two groups. A little difference was found in

the adolescent enlarged thyroid groups, the "acne present" group showing 27.2 per cent as against 21.8 per cent in the "acne not present" group. Again, comparing the nose, tonsils, and eyes, we have a very little increase in percentage in the "acne present" group over the other.

In their conclusions, the authors note "If we accept the theory that acne is due to an infection, this study would indicate that the infection is little influenced by systemic conditions."

FRANCIS B SHELDON, M.D.

THE SKIN (THERAPY)

A Case of Calcinosis Universalis, and a Suggested Method of Treatment. John Craig and Alexander Lyall. British Jour Child Dis., January-March, 1931, XXVIII, 29-34

A case of calcinosis universalis is reported in a child of five years. Hard lumps could be felt beneath the skin and X-ray plates showed diffuse calcification in the subcutaneous tissues. The child was given iodides, with massage, for three months without benefit.

Di-sodium phosphate by mouth was then substituted, in half-drachm doses three times daily for a week, then one drachm four times daily. In six weeks' time the masses had almost gone and very little calcification remained, as shown by subsequent X-ray examination. The authors give a short discussion of the rationale of this treatment.

E C VOGT, M.D.

Light Therapy in Skin Diseases. Walther Schultze. Strahlentherapie, May 20, 1931, XL, 601-610

This is a brief general discussion of the present status of light therapy in dermatology. The various schools of teaching are mentioned, and the importance of medical supervision is stressed. As far as the dosage of light is concerned, the author feels that the reproducibility of doses applied to the patient is a necessity.

"However," he states, "we do not know enough to day concerning the biologic effect of various parts of the spectrum to permit the adoption of a definite unit similar to the r in roentgen therapy."

ERNST A POHLE, M.D., Ph.D.

A Few Remarks about the Treatment of Rhinophyma. Albert Martin Cuadran. Med Ann Jour, November, 1931, XXVI, 589-591

Rhinophyma is the monstrous hypertrophy of the

end of the nose. This deformity is the final evolution of the rosacea, with folliculitis.

The local treatment of rhinophyma differs according to the stages of its evolution. At the onset, when it is still a rosacea, strong sulphurated lotions, and, notably, cryotherapy give excellent results. Carbonic dioxide snow is the treatment of choice for the rosacea when it presents but little folliculitis and fine telangiectasiae. Massage is a good adjunct.

At a later stage, when the skin is hypertrophied and the small veins which run into it are numerous and dilated, and folliculitis is marked, we must have recourse to more active measures. Positive electrolysis will block the vessels. Crossed linear scarifications will chop the telangiectasia and the sebaceous glands. Careful applications of filtered X-rays will diminish the recurrence of folliculitis. Nevertheless, these diverse treatments are insufficient when the affection becomes a genuine rhinophyma and the nose develops extraordinary proportions. We must then act energetically to free the patient from this deformity.

Decortication is the operation to be adopted. This consists in removing the surplus tissue, care being taken not to go too deeply, in order to leave sufficient tissue for epithelialization. Some authors recommend the use of high frequency currents, employed either for coagulating the rhinophyma or for endothermic ablation. The author does not recommend this procedure, because it is lengthy and uncertain in its results.

X-rays and radium are not of any use to reduce a rhinophyma. We would have to use such high doses as to cause severe radiodermatitis long before the nose would diminish in size.

The author presents photographic reproductions to illustrate one case treated by the surgical method.

L I CARTER, M.D.

The Distribution of Roentgen Rays in the Skin. V Wucherpfennig. Strahlentherapie, Oct 24, 1931, XLII, 544-550

The author states that isodose charts for radiation used in skin therapy have not been measured so far. It is necessary, therefore, to calculate the distribution of radiant energy in the skin. The accuracy of such a calculation depends, greatly, of course, on the conditions found in the individual case. A method is shown which permits the determination of the depth dose in superficial therapy by using the mass absorption coefficient for air and water. The results are recorded in a schematic cross-section of the skin, thus enabling the radiologist to read off the "depth dose" for radiations with a half value layer in Al from 0.25 to 4.0 mm in the first 12 mm of skin.

ERNST A POHLE M.D., Ph.D.

Action of Roentgen Rays of Different Quality on Psoriasis G A. Rost and Ph Keller Strahlentherapie, Oct 24, 1931, XLII, 539-543

The biologic effect of roentgen rays of different wave length has been most frequently compared on the basis of the skin erythema. The authors used a different reaction, namely, the changes produced in psoriatic lesions. The following qualities of radiation were used: 45 K.V., no filter; 75 K.V., no filter; 75 K.V. 1 mm Al; 138 K.V. 4 mm Al; 138 K.V. 0.5 mm Zn. The half value layers in Al were 0.3, 0.5, 1.5, 8.0, and 12.0 mm, respectively. Their therapeutic action on the skin lesions amounted to 150 per cent, 110 per cent, 110 per cent, 100 per cent, and 100 per cent, respectively, for the various qualities used. As a rule, the authors applied 100 r three times at ten-day intervals. It is also sometimes possible to remove the lesion in one sitting by from 300 to 400 r of a radiation with 0.5 mm Al H.V.L. If 600 r were applied, the lesions healed temporarily but recurred soon again.

From these observations the authors conclude that the longer wave length radiation is preferable. It would be possible to give 100 r two or three times at ten-day intervals over the scalp without producing epilation, provided a radiation with the H.V.L. in Al of 0.3 mm was used. If a higher H.V.L. was chosen, epilation often occurred. It must be remembered, however, that the soft radiation cannot be measured well with the Sabouraud-Noire pastille. It is necessary to correct for penetration. According to their experience, one Sabouraud-Noire dose corresponds to 550 r for a half value layer in Al of 0.28 mm., to 443 r for a half value layer in Al of 0.35 mm., to 317 r for 1 mm H.V.L., to 248 r for 1.5 mm H.V.L., to 293 r for 2.5 mm H.V.L., and 224 r for 3.4 mm. H.V.L.

ERNST A. POHLE, M.D., Ph.D.

THE SKULL (DIAGNOSIS)

Our Experience in Encephalography in Some Diseases of the Nervous System of the Child Piero Sighinolfi and Carolina Viola La Radiologia Medica, December, 1930, XVII, 1432-1456

The authors have performed encephalography on ten young patients for purely diagnostic purposes using Biengel's method. Although the cases selected were in extremely serious conditions, no operative mortality followed, nausea and vomiting were the only consequences observed.

The diagnostic points observed were undoubtedly precise, but the authors, nevertheless, think that encephalography is to be resorted to only in very special cases, because very little is to be gained, as far as curative treatment is concerned, by knowing exactly the position of a cerebral tumor.

They believe that pre-operative roentgenotherapy is advisable in conjunction with Biengel's method, because it will prevent sudden increases in liquid pressure.

L. MARINELLI

A Special Technic in X-ray Stereoscopy DeWitt R Austin South Med and Surg, October, 1931, XCIII, 755

The technic described is for use with the Bucky diaphragm at a distance of twenty-seven inches, and consists in shifting just half the usual distance with the tube. This furnishes a geometric correction for the increased distance between object and film, when using the Bucky grid. It is especially useful in securing stereoscopic films of the head.

W W WATKINS, M.D.

Arterial Encephalography Egas Moniz Bruxelles-Méd., Nov 1, 1931, XII, 22, 23

By the method of producing opacity of the arterial cerebral plexuses, the author has been able to localize tumors which clinical symptoms have failed to reveal.

Patients are prepared on the night preceding the operation, or on the morning of the operation, by luminal, with a view to avoid or diminish the epileptic symptoms which usually follow the injection, either of the internal carotid or of the common carotid. The vessel is exposed, if the common carotid is selected, the external carotid is temporarily obliterated with a Martins forceps in order that the opaque liquid may pass exclusively through the internal carotid.

The patient is placed under the X-ray tube, and is injected with from 5 to 6 c.c. of a solution of chemically pure sodium iodide, 22 or 23 per cent. A Martins forceps clamps the artery below the needle so as to momentarily block the circulation, although this precaution is not essential to allow the visibility of the cerebral arteries.

The one contra-indication is advanced arteriosclerosis, however, if the sodium iodide is chemically pure, complications are very rare.

The encephalographic test demonstrates the visibility of the internal carotid, especially its cavernous portion and the ophthalmic, anterior choroid, the sylvian group, and sometimes the anterior cerebral and its subdivisions.

The localization of certain very vascular tumors is detected by the visibility of their circulations. Their arteriographic aspects are different. Paucity of vascularity is found in cysts and cholesteatomas.

quite the contrary being found in meningoblastomas and other highly vascularized tumors

Arterial displacements facilitate the diagnosis of tumors of the frontal, parietal, and temporal lobes and, among others, of the regions of the chiasma and ponto-cerebellar angle.

HENRY BAXON, M D

Skull and Brain Traumas Their Sequelæ. Mark Albert Glaser and Frederick P Shafer Jour Am Med. Assn, Jan 23, 1932, XCVIII, 271-276

Two hundred and fifty-five cases were followed, one as long as five years after the accident. The series was subdivided into groups, depending on the presence and location of fracture the diagnosis of which was determined by roentgenography. Rupture of the ear membrane, with resulting hemorrhage or a distended bluish membrane, occurs with sufficient frequency to be utilized as a practical criterion of fracture through the petrous portion of the temporal bone. Mental disturbances and convulsive states were the only changes that manifested themselves at a period later than three months after injury.

In patients suffering from depressed fractures symptoms are less likely to develop than in those without fracture. Combined fractures of the base and vault are the most serious. The younger the patient, the less likely it is that symptoms or signs will develop. Headache was the most frequent complaint and developed more often in cases without skull fracture. Headaches persisting over one and a half years usually were permanent. Dizziness occurred more frequently in fractures of the base. Very little opportunity for recovery was evident when it persisted over one and a half years. Results of trauma affecting various nerves are reviewed. Positive neurologic signs occurred in 32.5 per cent while 80 per cent presented subjective complaints.

C G SUTHERLAND, M D

THE SPINE (DIAGNOSIS)

Absence of the Cervical Spine Klippel-Feil Syndrome George I Brumman Jour Am Med Assn, Jan 9, 1932, XCVIII, 129-132

Anomalies in the cervical spine are uncommon and especially rare are those described under the obscure term of the Klippel-Feil syndrome. This consists of a numerical variation in the cervical vertebrae accompanied in some cases by spina bifida or other anomalies. About thirty such cases have been reported, mostly in the French literature, three cases have been reported in America and one in England.

Five cases are reported and reviewed. Inability to dissociate the movements of the two hands, a phenomenon designated as mirror movements, was seen in four. The changes are all intra-uterine. A developmental anomaly primary in the nervous system, with an accompanying or resulting bone anomaly, may be assumed in a large percentage of cases. No treatment is of any benefit. Operations or active treatment should be avoided by a correct diagnosis.

C G SUTHERLAND, M D

Typhoid Spine. L K Wang and Leo J Miltner Chinese Med. Jour, January, 1932, XLVI, 1-11

The name "Typhoid Spine" was given by Gibney, in 1889, to a condition of the spine occurring in the wake of typhoid fever and characterized by pain and tenderness of a part of the vertebral column. Bone marrow in common with lymphoid structures offers a favorable location for the growth and multiplication of typhoid bacilli. After the general infection has subsided, the bacilli may be destroyed by the protective agents present, or may remain quiescent for a time, later becoming active. Muscle strain, trauma, fatigue, and exposure are considered as possible etiologic agents.

The three types of typhoid spine recognized pathologically are as follows: (1) Diffuse periostitis and perispondylitis with roentgenologic appearance similar to osteo-arthritis, (2) the localized or common type, with early destruction of the intervertebral disc. In this type healing occurs promptly, and (3) extensive destruction, as in osteomyelitis, with pronounced gibbus formation. Roentgenograms show at first marked bone destruction, and later filling out of the destroyed areas with marked osteogenesis between the vertebral bodies. The intra-articular facets, pedicles, transverse processes, and laminæ are not involved in any of these types except late in the healing stage, at which time these structures may show evidence of osteo-arthritis.

The onset may be insidious or sudden, with rise in temperature and severe pain in the affected region. Local tenderness and rigidity are nearly always present. Various sensory disturbances in regions supplied by the nerves of the affected levels have been described. The blood count is considered of no value in the diagnosis.

Tuberculosis of the spine, osteomyelitis of the spine, and low back pain of arthritic nature must be considered in the differential diagnosis of typhoid spine. At the onset of clinical symptoms of sufficient importance to demand attention in tuberculosis of the spine, the X-ray usually reveals the existence of an extensive lesion, whereas in typhoid spondylitis an early X-ray examination shows either no change or slight destruction of the intervertebral disc. If the history of typhoid fever is indefinite

and the X-ray suggests the possibility of either condition, the Widal test aids in the diagnosis. In typhoid spine, as a rule, there is definite roentgenographic evidence of bony condensation and ankylosis of the involved vertebrae within three or four months' time, whereas in tuberculosis of the spine similar evidences of healing, if present, occur usually from two to ten years after the onset. The presence of a spinal abscess is strongly in favor of tuberculosis. In acute osteomyelitis of the spine the local phenomena are intense and the leukocyte count is, as a rule, very high. Low back pain of arthritic nature may be eliminated by the history of onset, the absence of a history of typhoid fever, and the absence of changes demonstrable by the X-ray.

The prognosis in this condition is almost always favorable and with proper treatment very little deformity results. The treatment consists of proper immobilization of the spine during the acute stage, typhoid vaccine, foreign protein therapy, colonic irrigations, and complete rest in bed until all pain has passed and the roentgenograms show evidence of healing of the affected vertebrae.

The authors report two cases of typhoid spine, one of which also presented a sacro-iliac arthritis of similar etiology.

I. N. AVÉ, MD

Scoliosis Etiology, Pathogenesis, and Prevention of Experimental Rotary Lateral Curvature of the Spine. Eben J. Carey. Jour. Am. Med. Assn., Jan. 9, 1932, XCVIII, 104-110.

Scoliosis is now definitely known as rotary lateral curvature of the spine. It is a spinal sign of the muscle-bone imbalance of the back, and not a specific disease entity. The kind and degree of scoliosis are dependent on the extent of imbalance caused by the possible multiple combinations and permutations of the paralyzed muscles of the body as a whole.

The problem of scoliosis is one of prevention of all conditions that upset the normal balance of muscle and bone during growth, such as chronic inanition and malnutrition and the various types of chronic disease which lead to undernourishment of the growing child.

C. G. SUTHERLAND, MD

An Hemangioma of a Vertebra, Demonstrated Roentgenographically. A Reisner Rontgenpraxis, Oct 1, 1931, III, 900-903.

Hemangiomas of a vertebra are not rare in autopsy material (from 10 to 12 per cent). Clinically they occasion symptoms only when they cause pressure on the spinal cord. The roentgen appearance

of a vertebral hemangioma is typical, if one consults the literature. The bony portion of the vertebra (usually a lower thoracic or upper lumbar) only is attacked, the discs are intact, the normal bone structure is changed into dense, calcified strands, which run mainly in a vertical direction and enclose areas where calcium is absent. A case is described which showed all these signs in the tenth dorsal vertebra.

H. W. HEFKE, MD

Evaluation of the Different Symptoms in Diagnosis of Conditions of the Vertebrae. Hans Hellner. München med Wochenschr., Sept. 4, 1931, LXXVIII, 1511-1515.

In the diagnosis of injuries and diseases of the spine, the roentgen findings are usually of more value than the clinical examination alone. The X-ray gives more detail as to conditions of the body of the vertebra, the inter-vertebral disc, the degree of bone destruction, and of accompanying spondylitis or synostosis. Fractures occur most frequently in the twelfth dorsal and first lumbar vertebra. Regarding the type of fracture, the compression leaving a wedge-shaped body is the most common. With increasing force of the impact, the vertebra receives the shape of a disc, with the anterior portion of the body protruding in front of the spine, and even breaking off in a triangular shape. Luxation plus fracture is due to a tearing off of the lateral portion of the vertebra. Tuberculosis also has its place of predilection. Bergmann found, in 342 cases, the twelfth dorsal in 24.6 per cent, the eleventh dorsal in 20.5 per cent and the first lumbar in 18.7 per cent of the cases involved. The majority of cases has more than one involved. The inter-vertebral disc is usually affected. A gibbus, with angulation of the spine occurs early. Roentgenologically, the disc is not narrowed in fractures. Only in very severe cases of compression do we find a narrowing, but in tuberculosis one frequently finds a moth-eaten defect. This can be used for differential diagnosis between a healed fracture and a tuberculous process. Even if a fracture has resulted only in an injury to the disc and has injured the anterior part of it, with bridge formation, the rest of the disc is smooth—a condition which can never be seen in tuberculosis although there are many ways to determine tuberculosis by the X-rays.

In some cases a healed fracture cannot be distinguished from a case of healed spondylitis (Kohler). The changes produced by typhoid, paratyphoid, gripppe, or pneumococcal spondylitis are similar to those of tuberculosis and can be recognized only by considering also the clinical side of the case. Acute purulent osteomyelitis is characterized by the

acute septic condition of the patient and also by the almost ever-present purulent spinal meningitis. On the X-ray one finds destruction frequently in the arc of the vertebrae. In malignancy the metastasis may produce changes similar to those one sees in tuberculosis, but usually the formation of a gibbus is late. If the lesion is in the spongiosa it must be larger than the size of a pea in order to be recognized on the film. The differential diagnosis between carcinoma and myeloma is very difficult. Besides these osteoclastic types of lesions, the osteoplastic carcinoma and Paget's disease must be mentioned.

E A MAY M.D.

A Case of Congenital Dorsal Scoliosis Associated with Bilateral Traumatic Paralysis of the Klumpke Type Giulio Faldini L'Ateneo Parmense (Suppl.), 1931, III, 108-116

The radiographic examination showed a scoliosis of the right dorsal spine, with a steep curve, due to the subsequent malformations.

Interpretation of the case is difficult, owing to the fact that factors of various nature are encountered in a limited anatomic space, which must be evaluated in conjunction with each other in order that a clinically logical explanation of the syndrome may be reached. The paralysis was marked by characteristic atrophy, but without sensitive phenomena. The author concludes that the pathogenesis of the paralysis is not to be sought in the congenital deformity but that this must be regarded as merely a slight and occasional concomitant factor.

W W WHITELOCK Ph.D.

Calcification of the Nucleus Pulposus of the Intervertebral Disc. Renato de Bernardi Archivio di Radiologia, May-June, 1931, VII 537-556

The author thinks that this lesion is part of a morbid process which involves the whole intervertebral disc and is not a lesion *per se*. This process is of an inflammatory nature, due to some generalized infection which may manifest itself in the advanced stages, either as spondylitis deformans or as spondylitis of Bechterew's type.

E T EDDY M.D.

An Erroneous Diagnosis of Fracture and Dislocation of the Second Cervical Vertebra Emil Kleinhaus Röntgenpraxis, Sept 15, 1931 III 836-839

A diagnosis of fracture of the dens of the second cervical vertebra with anterior dislocation had been made in a patient, who suffered an injury to the head. The anteroposterior film through the open

mouth showed no pathologic changes. On the lateral view the second vertebra seemed to be definitely dislocated anteriorly. This, however, can be explained by a wrong technic. The head and the first cervical vertebra were in a straight lateral position, while the rest of the cervical spine was rotated only 45 degrees. The same appearance could be duplicated in a normal person. The head and the cervical spine must necessarily be projected on the film from the same angle, in order to avoid diagnostic mistakes as the one described above.

H W HEPKE, M.D.

Sacralization R Hirsch Fortschr a d Geb d Röntgenstr , August, 1931, XLIV, 215-226

True sacralization, that is, synostosis of the fifth lumbar and first sacral segments, was not found in 1,000 lower spines studied during five years. Pseudo-sacralization, that is, uni- or bilateral articulation between the transverse processes of the fifth lumbar vertebra and the sacrum, was found in 13 per cent of these cases. In 24 per cent, the transverse processes of the fifth lumbar vertebra were smaller than those of the fourth, and also 24 per cent of lumbarizations or sacralizations were found.

It is demonstrated from case histories that the symptomatology attributed so often to sacralization, enlargement of the fifth lumbar transverse processes, etc., is even more frequently encountered in especially small fifth lumbar transverse processes. The disease entity postulated for sacralization, therefore, must be denied, and radical surgical procedures as advocated and practised, especially in France, are to be replaced by conservative methods.

HANS V JARRE, M.D.

SYPHILIS

Gastric Syphilis K. J Yeo British Jour Radiol, October, 1931, IV, 510-512

Serial roentgenologic observations were made of a married woman, 21 years of age, who for six months had suffered from gnawing epigastric pain, worse immediately after eating, of rather continuous character, associated with a considerable weight loss. On first roentgenologic examination nothing other than a mild hour-glass type of spasm in the pyloric region was noted. Weight loss continued. A year later a second X-ray observation was made, at which time extreme narrowing, with some shortening of the lower part of the stomach, was observed. The affected area was 5 centimeters long, the diameter of the lumen varying from less than 1 to less than 3 centimeters. The narrowed part appeared rigid and showed no peristalsis. The pylorus was continuously open with resultant rapid emptying. Wassermann

and the X-ray suggests the possibility of either condition, the Widal test aids in the diagnosis. In typhoid spine, as a rule, there is definite roentgenographic evidence of bony condensation and ankylosis of the involved vertebrae within three or four months' time, whereas in tuberculosis of the spine similar evidences of healing, if present, occur usually from two to ten years after the onset. The presence of a spinal abscess is strongly in favor of tuberculosis. In acute osteomyelitis of the spine the local phenomena are intense and the leukocyte count is, as a rule, very high. Low back pain of arthritic nature may be eliminated by the history of onset, the absence of a history of typhoid fever, and the absence of changes demonstrable by the X-ray.

The prognosis in this condition is almost always favorable and with proper treatment very little deformity results. The treatment consists of proper immobilization of the spine during the acute stage, typhoid vaccine, foreign protein therapy, colonic irrigations, and complete rest in bed until all pain has passed and the roentgenograms show evidence of healing of the affected vertebrae.

The authors report two cases of typhoid spine, one of which also presented a sacro-iliac arthritis of similar etiology.

I N A N E, M D

Scoliosis Etiology, Pathogenesis, and Prevention of Experimental Rotary Lateral Curvature of the Spine Eben J. Carey, Jour Am Med Assn, Jan 9, 1932, XCVIII, 104-110

Scoliosis is now definitely known as rotary lateral curvature of the spine. It is a spinal sign of the muscle-bone imbalance of the back, and not a specific disease entity. The kind and degree of scoliosis are dependent on the extent of imbalance caused by the possibly multiple combinations and permutations of the paralyzed muscles of the body as a whole.

The problem of scoliosis is one of prevention of all conditions that upset the normal balance of muscle and bone during growth, such as chronic inanition and malnutrition and the various types of chronic disease which lead to undernourishment of the growing child.

C G SUTHERLAND, M D

An Hemangioma of a Vertebra, Demonstrated Roentgenographically A Reissner Röntgenpraxis, Oct 1, 1931, III, 900-903

Hemangiomas of a vertebra are not rare in autopsy material (from 10 to 12 per cent). Clinically they occasion symptoms only when they cause pressure on the spinal cord. The roentgen appearance

of a vertebral hemangioma is typical, if one consults the literature. The bony portion of the vertebra (usually a lower thoracic or upper lumbar) only is attacked, the discs are intact, the normal bone structure is changed into dense, calcified strands, which run mainly in a vertical direction and enclose areas where calcium is absent. A case is described which showed all these signs in the tenth dorsal vertebra.

H W HEFKE, M D

Evaluation of the Different Symptoms in Diagnosis of Conditions of the Vertebrae Hans Hellner München med Wochenschr, Sept. 4, 1931, LXXVIII, 1511-1515

In the diagnosis of injuries and diseases of the spine, the roentgen findings are usually of more value than the clinical examination alone. The X-ray gives more detail as to conditions of the body of the vertebra, the inter-vertebral disc, the degree of bone destruction, and of accompanying spondylarthritis or synostosis. Fractures occur most frequently in the twelfth dorsal and first lumbar vertebrae. Regarding the type of fracture, the compression leaving a wedge-shaped body is the most common. With increasing force of the impact, the vertebra receives the shape of a disc, with the anterior portion of the body protruding in front of the spine, and even breaking off in a triangular shape. Luxation plus fracture is due to a tearing off of the lateral portion of the vertebra. Tuberculosis also has its place of predilection. Bergmann found, in 342 cases, the twelfth dorsal in 24.6 per cent, the eleventh dorsal in 20.5 per cent, and the first lumbar in 18.7 per cent of the cases involved. The majority of cases has more than one involved. The inter-vertebral disc is usually affected. A gibbus, with angulation of the spine, occurs early. Roentgenologically, the disc is not narrowed in fractures. Only in very severe cases of compression do we find a narrowing, but in tuberculosis one frequently finds a moth-eaten defect. This can be used for differential diagnosis between a healed fracture and a tuberculous process. Even if a fracture has resulted only in an injury to the disc and has injured the anterior part of it, with bridge formation, the rest of the disc is smooth—a condition which can never be seen in tuberculosis, although there are many ways to determine tuberculosis by the X-rays.

In some cases a healed fracture cannot be distinguished from a case of healed spondylitis (Köhler). The changes produced by typhoid, paratyphoid, grippe, or pneumococcal spondylitis are similar to those of tuberculosis and can be recognized only by considering also the clinical side of the case. Acute purulent osteomyelitis is characterized by the

points from a single case report. He believes that in most cases the diagnosis of thymoma can be made with considerable certainty from the clinical findings alone, while in some this may be impossible, even on necropsy and histologic examination.

At necropsy on a woman, who had shown all the clinical signs of severe myasthenia, the anterior mediastinum was found to contain a hard tumor corresponding histologically to Schmincke's lympho-epithelial tumor. Apparently it was benign, no metastases being found. Histologic examination of the musculature of the diaphragm, tongue, throat, esophagus, and abdominal wall showed degenerative changes in the muscles themselves, reactive and chronic inflammatory changes in the perimuscular and perivascular connective tissue, and, in places, dense round-cell infiltration (Buzzard's lymphorrhagia). Possibly these changes were due to a toxic agent produced by the thymus.

F CAVERS, D.Sc.

THE THYROID (THERAPY)

Concerning the Question of the Treatment Method of Toxic Goiter E. Hayer Strahlentherapie, Oct 24, 1931, XLII, 414-424

The fundamental difference between surgical and radiologic treatment of toxic goiter is outlined. While the operation seeks to remove in one sitting as much of the thyroid tissue as can be safely done without producing myxedema, irradiation causes a slow regression of the functioning cells. It seems that from 40 to 60 r are sufficient to reduce the secretion. The author has grouped his seventy-six cases of irradiated thyrotoxicosis according to the basal metabolic rate.

The first group consists of cases with +70 or more, the second group with from +40 to 70, and the last group +40 or less. In the first group there were twenty-four patients, nine of whom were cured, nine considerably improved, four not improved, and two died. The respective figures for thirty-five cases belonging to the second group are eleven, twenty, three, and one, and for the third group of seventeen cases they are four, eight, four, and one.

An analysis of the statistics shows that the most severe cases responded well, while those of simple hyperfunction received the least benefit from irradiation. It is necessary to select the proper cases for radiation therapy, for instance, large nodular struma should be treated surgically. Very often there are other glands of internal secretion involved. In such cases the author has seen good results from an additional exposure of the hypophysis. He concludes that at present no final decision can be made as to the efficacy of X-ray therapy in toxic goiter.

ERNEST A. POMIE M.D. Ph.D.

Concerning the Radiation Treatment of Thyrotoxicosis Robert Gantenberg Strahlentherapie Oct. 24, 1931, XLII, 401-413

The author first discusses the literature concerning radiation therapy of Basedow's disease and then presents a tabulation of the statistics published so far. In his own clinic he observed ninety-three cases which were subjected to radiation therapy. Fields of 6 X 8, 8 X 10, and 10 X 10 sq cm were used at 30 cm FSD, 180 K.V., 3 ma, 0.5 Cu + 1 Al. The left and right lobe of the thyroid received from 20 to 30 per cent H.E.D., very often from 10 to 20 per cent were applied as a single dose in acute and severe cases. The thymus area was exposed with 30 per cent H.E.D. Intervals of from two to three days were observed between the exposures. The total dose of an entire series amounted to from 70 to 90 per cent H.E.D. Then followed an interval of from four to eight weeks before another series was started. The effect of the radiation was controlled by basal metabolic rate determinations, if it had dropped to from 20 to 25 per cent, treatment was usually discontinued.

The author differentiates the true Basedow's disease with all the classical symptoms from the so-called "hyperthyroid complex," in which the signs are hyperfunction with struma but without exophthalmos. The rôle of the basal metabolic rate in determining the improvement is analyzed in detail. It is also important to follow the subjective symptoms as, for instance, excessive perspiration, tachycardia, tremor, and gastro-intestinal disturbances. The end-results are compiled in a table where cases are divided into those of true Basedow's disease and hyperthyroidism. In each group the patients are arranged according to the severity of symptoms. There were sixty-four cases of Basedow's disease, thirty severe, twenty-two moderately severe, and twelve beginning cases. Of the first group, six were cured, seven considerably improved, eleven temporarily improved, and six did not respond. The respective figures for the second group were four, eight, eight, and two, and for the third group, four, two, three, and three. There were twenty-nine cases with hyperthyroidism. Five of these were severe cases, none of those was cured, two were considerably improved, two temporarily improved, one remained unchanged. Of the remaining twenty-four moderate and early cases, nine were cured, three considerably improved, nine temporarily improved, and three remained unchanged.

In conclusion, the author states that about 50 per cent of the cases with hyperfunction were cured or considerably improved, while 20 per cent of the patients with true Basedow's disease were completely cured. He feels that radiation therapy in toxic goiter may be given a trial unless there are definite indications for immediate operation. Cases which do not show any improvement after three or four

and Kahn tests were strongly positive, a fractional gastric analysis showed complete achlorhydria.

Under anti-syphilitic treatment the symptoms rapidly disappeared and the normal weight was quickly regained X-ray studies during treatment and after completion of it showed slight but definite changes in the form of a widening of the affected portion of the gastric lumen

J E HABBE, M D

Considerations on Two Hundred Cases of Congenital Syphilis T Valledor Boletin de la Sociedad Cubana de Pediatría, June, 1931, III, 221-230

The author introduces here a good outline on the subject. He states that specific osteochondritis and periostitis occur in about 5 per cent of the cases, as shown by X-rays of this series. According to him, the most common symptoms are splenomegaly, hepatomegaly, mucopurulent corvza, cutaneous syphilitides, painful insomnia, testicular tumefaction, digestive disturbances, *et cetera*

N G GONZALEZ, M D

The Diagnosis of Syphilitic Aortic Insufficiency and Its Difficulties According to Statistics of Eighty-four Cases of Solitary Aortic Insufficiency of Adults, with Autopsy (Radioscopic Examination, Pt XIV, 573-577) L Gallavardin and L Gravier Jour Med de Lyon, Oct 5, 1931, XII, 567-583

The authors enter into an exhaustive and impartial discussion of the results obtained by radioscopic examination of the aorta during the course of aortic insufficiency, a subject fraught with difficulties. They point out that although in some cases the evidence of syphilitic aortitis is well demonstrated, it may, in others, be entirely absent, aortic insufficiency in itself being capable of imprinting on the aorta important changes which may in no way be associated with syphilis. The subject is divided into the following:

(a) Aortic insufficiencies with radiologic findings, diagnostic of syphilitic aortitis, such as a sacciform aneurysm of the aortic arch, or those cases of large dilations of the vessel reaching or even exceeding 5 centimeters. Such dilations cannot be due to senile changes nor to atheroma, they are to be regarded as true stigmas of aortic syphilis.

(b) Syphilitic aortic insufficiencies without radiologic signs of syphilitic aortitis. These are numerous, especially in patients relatively young, from 45 to 50 years of age, in whom the aortic diameter is scarcely 2 or 3 mm in excess of the normal at that age.

(c) Endocardial aortic insufficiencies which, from the very existence of insufficiency, are accompanied

by important modifications of the aortic shadow. Even in young patients, the differential pressure rises as the aortic regurgitation and the left ventricular hypertrophy increase, causing the aorta to enlarge frequently from 2 to 4 mm beyond its normal diameter, according to the patient's age. It is more especially at ages over 55 years that radioscopy discloses frequent notable changes of the aortic shadow, these changes involving particularly the caliber and opacity of the aorta, however, the authors have never seen the aorta reach 5 centimeters.

(d) Radioscopy in aortic insufficiencies of doubtful etiology, whether syphilitic or endocardial. Here the authors discuss at length the diagnostic value of accentuation of the curves of the arch, the aortic caliber, and the exaggeration of aortic opacity, this last sign being considered by some as the most significant of syphilitic aortitis.

The authors conclude that radiology fails to yield all the assistance to the subject which could apparently have been expected by those who believe that alterations in the aortic walls are always indicative of syphilitic aortic insufficiencies. It has demonstrated that the same condition may be found, although less frequently, in endocardial aortic insufficiencies of older patients. But even though radioscopy often fails to solve the etiologic problem of a diastolic aortic murmur, its importance should not be underestimated. In a few cases, at least, it demonstrates the syphilitic nature of vascular specific aortitis. Besides, in a large percentage of cases, radioscopy furnishes useful information which, although not having in itself an absolute value, is of very material clinical assistance.

HENRY BAYON, M D

THE THYMUS (DIAGNOSIS)

Congenital Enlargement of the Thymus Gland Report of Case Henry E Stafford Arch Pediatrics, June, 1931, XLVIII, 386-389

A case is reported of a newborn infant whose chief symptoms were dyspnea, cyanosis, and mucus in the throat. Particularly on account of the improvement which followed radiation therapy, the author was quite convinced that he was dealing with an enlarged thymus.

E C VOGT, M D

Diagnosis and Treatment of Thymoma L F Craver Med Chn N America, September, 1930, XIV, 507-525 (Reprinted from "Cancer Review" by permission)

In this excellent paper the author limits his discussion to the clinical diagnosis and irradiation treatment of thymic tumors, and illustrates most of his

points from a single case report He believes that in most cases the diagnosis of thymoma can be made with considerable certainty from the clinical findings alone, while in some this may be impossible, even on necropsy and histologic examination

At necropsy on a woman, who had shown all the clinical signs of severe myasthenia, the anterior mediastinum was found to contain a hard tumor corresponding histologically to Schmincke's lympho-epithelial tumor Apparently it was benign, no metastases being found Histologic examination of the musculature of the diaphragm, tongue, throat, esophagus, and abdominal wall showed degenerative changes in the muscles themselves, reactive and chronic inflammatory changes in the perimuscular and perivascular connective tissue, and, in places, dense round-cell infiltration (Buzzard's lymphorrhagia) Possibly these changes were due to a toxic agent produced by the thymus

F CAVERS, D Sc

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ERNST A PONILE M D Ph D

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(but not exceeding six) months should be operated on. The same holds true of patients with acute symptoms. In the remaining cases of toxic goiter, radiation therapy combined with medical treatment is the method of choice.

ERNST A. POHLE, M.D., Ph.D.

THE TONSILS

Tonsillectomy Following Irradiation in Lymphosarcoma of the Tonsils A Successful Case without Recidivation for Six Years D G W Van Voorthuysen Geneeskundig Tijdschr voor Nederlandsch-Indie, Dec 1, 1931, LXXI, 1425-1427

Malignant tumors of the tonsils show, according to their nature, varying prognoses. Lymphosarcomas seem to offer the greatest hope, as they are very responsive to irradiation, and at times disappear with astonishing rapidity, although recidivation after a longer or shorter period generally serves to destroy the early satisfaction in the apparent recovery. With the improvement in roentgen technique and the employment of radium better results have undoubtedly been obtained, although recidivation is still very frequent.

The author reports a case of lymphosarcoma of the tonsils, in which biopsy was indecisive, with regional metastases of the lymphatic glands of the lower jaw and neck, as shown by extirpation. The sarcoma finally disappeared, following roentgen irradiation. There was speedy recidivation, but the sarcoma again disappeared following renewed irradiation, and after tonsillectomy failed to reappear. There was no further recidivation for six years, down to the time of the patient's death, which was from other causes.

W. W. WHITELOCK, Ph.D.

TUBERCULOSIS (DIAGNOSIS)

Diagnosis and Treatment of Tuberculosis of the Small and Large Intestine Lawrason Brown and Homer L. Sampson Jour Am Med Assn, Jan. 2, 1932, XCVIII, 26, 27

Intestinal tuberculosis may be primary or secondary, the former being largely of surgical interest, while the latter is almost always associated with pulmonary tuberculosis and constitutes its most frequent amplification. Of 1,801 consecutive patients at the Trudeau Sanatorium, 8 per cent had definite intestinal tuberculosis.

The roentgen method of diagnosis reveals only the presence of intestinal ulceration, but, when associated with pulmonary tuberculosis, especially if the pulmonary disease is at all advanced, it is safe to

make a diagnosis of intestinal tuberculosis. Roentgen technic may not reveal the whole extent of the involvement.

Suggestive symptoms of beginning intestinal tuberculosis include, among others, any digestive disturbances, marked constipation, failure of the pulmonary condition to improve, an irregular temperature with subnormal fluctuations, possibly a decrease of pulmonary symptoms (while the patient is no better), alternating diarrhea and constipation, and marked nervousness.

Symptoms are often absent and abdominal and proctoscopic examinations are often negative. One must, therefore, turn to a study of the barium meal at the seventh, eighth, ninth, and tenth hours, and again at the twenty-fourth hour. The barium enema usually confirms the fact that the ulcerated cecum or other portions of the colon may fail to receive or to retain the barium.

C. G. SUTHERLAND, M.D.

The Diagnosis of Co-existing Emphysema and Pulmonary Tuberculosis W. C. Nalty Med Bull Veterans' Administration, January, 1932, VIII, 50-52.

Emphysema, a dilatation of the alveoli of the lungs, characterized by a change in the shape of the chest and by changes in the breath sounds, may be the result of whooping cough, asthma, bronchitis, or tuberculosis. It is considered difficult to attempt the diagnosis of tuberculosis upon the history and physical examination alone in a patient having emphysema, either with or without a co-existing asthma or bronchitis, because the findings of the latter conditions overshadow the usual findings of pulmonary tuberculosis.

The history of cough and expectoration is of little value, as these symptoms are common to tuberculosis, asthma, and bronchitis. On inspection an emphysematous chest may be mistaken for an exceedingly well-developed chest. Palpation may reveal negative findings, and, on percussion, a hyperresonance, rather than the usual dullness, may be elicited. On auscultation the usual breath sound changes of emphysema overshadow the findings of tuberculosis. The associated bronchitis or asthma may likewise hide the usual signs of pulmonary tuberculosis. A sputum positive for tubercle bacilli will prove the association of tuberculosis and asthma. However, pulmonary tuberculosis should not be eliminated because a negative sputum is obtained. The author is of the opinion that in many of these cases X-ray examination is usually the only means of establishing a diagnosis of pulmonary tuberculosis. In those cases in which the diagnosis has been made by other means, X-ray examination offers the only method of establishing the amount

of lung tissue involved. The author reports several cases of emphysema associated with tuberculosis, which illustrate the difficulty of the differential diagnosis of these conditions.

J N ANE, MD

The Epitheloid-cellular Type of Lung Tuberculosis (Sarcoid) Held Röntgenpraxis, Oct 15, 1931, III, 927-932

The author describes three typical cases of tuberculosis of the lungs which correspond to the so-called sarcoid. Their appearance is much like the disseminated type of Hodgkin's disease of the lungs. All of them began with an erythema nodosum. Histologic examination in one case confirmed the diagnosis of tuberculosis. Tubercl bacilli could not be demonstrated in the sputum. The spread of the infection probably takes place by way of the blood stream from diseased hilum glands. Enlargement of the hilum glands seems to be a more or less constant finding in roentgenograms of patients with this disease. Why it does not lead to an acute miliary tuberculosis can be explained only by the immune state of the patient. The localization of the foci in the interstitial tissue of the lungs is probably explainable by this positive anergy.

H W HEFKE, MD

Tuberculosis of the Jejunum Franklin W White and I R Jankelson Jour Am Med Assn, Jan 2, 1932, XCVIII, 23-26

At autopsy there are signs of tuberculosis of the bowels in approximately 50 per cent of those who die of pulmonary tuberculosis. Intestinal involvement may occur at any stage of the pulmonary infection, being more common in the advanced and active cases. Multiple lesions are the rule, the most common location being the lower ileum and ileo-cecal region. The jejunum is frequently involved in the terminal stage of an extensive tuberculosis of the bowels. It is rare to find isolated tuberculosis of the jejunum without tuberculosis elsewhere in the bowel. Symptoms of intestinal tuberculosis may be absent or very vague. The present-day roentgen technic does not readily visualize the jejunum. Tuberculosis of the jejunum is one of the most frequent causes of jejunal stenosis.

Two cases are reviewed and discussion of the pathology, symptoms, and diagnosis follows. The technic of the roentgen examination includes the "scout" film, valuable only when the bowel is distended above the lesion, and frequent observations in the first six hours after the barium meal, since evidence of partial obstruction is apt to be transitory.

C G SUTHFRLAND, MD

Roentgenologic Diagnosis of Pulmonary Tuberculosis Walter R Wynne Med Bull Veterans' Administration, December, 1931, VII, 1153-1159

The author discusses the important factors in the roentgenologic diagnosis of pulmonary tuberculosis. Proper technic, with attention to all details, is considered of the utmost importance. A competent roentgenologist should supervise all roentgenographic examinations in the department and this should never be left to the judgment of the technician.

Contrast, detail, and density, in proper relation, are necessary to make a good roentgenogram, and when any one of these is left out, there results a film that should not be interpreted. Contrast is controlled chiefly by the amount of X-ray energy applied to the films, and detail by the size of the focal spot of the tube and also by the film focal spot distance. The author believes that stereorontgenograms, made with the patient standing, offer more valuable assistance in the routine case than those taken in other positions. The author also emphasizes the importance of a careful dark room technic.

In the interpretation of chest films the stereorontgenograms should be studied only in the position in which they were taken. The quality of the films should always be noted, and if found unsatisfactory the examination should be repeated. The size and shape of the chest should next be studied. The position of the trachea, and the size, shape, and position of the blood vessels and heart should then be observed. Special notes are made of normal or abnormal markings of each dome of the diaphragm and of both costophrenic angles.

In studying the lungs the trachea should be traced down to the carina, and the hilum observed for abnormalities. The trunk markings should next receive the attention of the roentgenologist and each trunk should be followed from the hilum to the periphery. In localizing foreign bodies in the right lung it is well to remember that the pulmonary artery enters the lung below the trunks to the upper lobe and above those to the middle and lower lobes. In the normal lung the structures just under the pleural surface cannot be seen.

In pulmonary tuberculosis we see a fight staged for the establishment of the tubercle bacilli on the one hand and a defensive reaction on the other to repel the invasion. Once the exudation has started in a primary lobule, it immediately involves all the others making up one of the secondary lobules, but this reaction does not extend through the septa until ulceration takes place. In adult apical pulmonary tuberculosis there occurs an involvement of many secondary lobules near the pleural surface in the upper part of the lung. At this time, no other known pathologic conditions can produce such changes. A few other conditions, such as influenza and septic pneumonitis, may involve the secondary lobules in the upper portion of the lung and just

under the pleural surface, but in these other conditions the involvement is all in one stage and not in crops, as seen in tuberculosis. The puerile and basal involvement of pulmonary tuberculosis cannot always be distinguished from other diseases. Other pulmonary diseases, likewise, may produce enlargement and calcification of the glands and thus closely simulate the glandular form of pulmonary tuberculosis, this form, however, showing evidences of caseous changes as well as calcification.

Dunham believes that miliary tuberculosis is always the result of reinfection of an old focus. This form of pulmonary disease is believed to be the result of a lack or loss of immunity. Many cases of healed miliary tuberculosis are being found in X-ray laboratories with modern technic and interpretation. The appearance is that of a fine, sharp, discrete studding, more or less evenly distributed throughout all the lobes. In the more recent cases distribution is similar, but instead of studding, there is a fine mottling which has not reached the definitely calcareous stage.

J N AVÉ, MD

affirmatively to the above question, at least as regards cases not entirely obscure in etiology or rendered deceptive by a completely misleading aspect, both on the basis of a study of the literature and of a personal case in which the definite diagnosis of "primitive tuberculous splenomegaly" was later confirmed by anatomic investigation.

The present-day methods of investigations, although they have not overcome the inherent difficulties of diagnosis in the more obscure cases, show distinct advance over those of an earlier date and permit recognition of primitive tuberculous foci and signs of latent activity of the disease. In addition direct radiographic examination of the splenic tumor has been suggested for possible demonstration of calcified nodules attributable to the specific process. In this connection, however, the siderotic-calcareous nodules of the Gamma type must be borne in mind as a possible cause of the shadow. In any event, radiologic investigation serves as an adjuvant to disclose the connections of the organ with adjacent viscera, and also, naturally, the presence of other plastic and calcified masses.

W W WHITELOCK, PhD

The Present Conception of Pulmonary Tuberculosis W Jost. Schweiz med Wehuschr, Aug 22, 1931, LXI, 789-792

The author first questions which teaching one should believe the old, which conceives the typical involvement to be primary with gradual extension or the new, which conceives the origin to be acute affecting any portion of the lung, with extension in acute stages. The fact that the "früh-infiltrat" has comparatively, only recently achieved much attention, despite the fact that roentgenographic technic has changed little, argues for an increasing incidence of the acute type.

Since the acute "früh-infiltrat" is variable in location, gives few clinical signs, and may be found in an individual who appears to be healthy, X-ray examination is extremely important. It is far better to make too many radiographs than too few.

H C OCHSNER, MD

Forms of Pulmonary Tuberculosis in Early Infancy Edgar Filgueiras Archivos de Pediatría, Rio de Janeiro, January, 1931 Reprinted in Boletín de la Sociedad Cubana de Pediatría, June, 1931, III, 233-236

The purpose of this paper is to call the attention of physicians to the frequency of pulmonary tuberculosis in infancy and the necessity of an early diagnosis and proper treatment.

To the author, the most important symptoms are Failure to gain weight or loss of weight, restlessness, loss of appetite, afternoon fever, cough, and digestive disturbances. He states that the X-ray always either confirms or makes the diagnosis.

N G GONZALEZ, MD

Primitive Tuberculosis of the Spleen Pathogenetic and Clinical Notes Enrico Greppi Riv d Patol e Clin d Tuberc, Dec. 31, 1931, V, 1025-1036

Is diagnosis, or at least a diagnostic suspicion founded on a concrete basis, possible in the living subject in this obscure disease on which pathologic and clinical text-books have so little to say that is of a definite and helpful nature?

The author believes himself justified in replying

Silicosis and Pulmonary Tuberculosis J C Herrick Med Bull Veterans Administration, November, 1931, VII, 1063, 1064

It is generally believed that silica dust is the most injurious of all the various materials which produce pneumoconiosis. Particles of silica carried into the lung tissues dissolve slowly, react chemically upon the cells containing them, and cause cell death. The dead cells collect and block up the lymph chan-

nels and glands. The necrotic tissue so caused forms a lodging place in which the tubercle bacilli grow. In those cases uncomplicated by tuberculosis the final result is the formation of fibrous tissue, which in time replaces the normal alveolar structure of the lungs.

Of importance is the fact that, once the silica dust has gained access to the lungs, the silicotic process continues to advance, even after complete withdrawal from exposure. A tuberculous infection in a lung containing silica particles runs an unusually rapid and fatal course. Silicosis, uncomplicated by tuberculosis, may also terminate fatally.

The author reports two cases of miners, with sputa positive for tubercle bacilli, in which evidences of silicosis were found by clinical and roentgenologic examinations. Both cases terminated fatally after severe pulmonary hemorrhages. An autopsy was performed in one case.

J N ANÉ, MD

The Onset of Pulmonary Tuberculosis in the Adult Radiologic Part Luigi Turano *Il Giornale di Tisiologia*, Nov 30, 1931, X, 303-318

The author discusses the value of radiology in determining the existence of incipient pulmonary tuberculosis, but points out the necessity of constant collaboration of radiologist and clinician. Without anatomic-pathologic control, it is impossible to judge accurately as regards the significance of certain radiologic findings. With this reservation, he formulates the following conclusions:

Radiologic investigation, especially in the form of radiographs, is absolutely indispensable in determining the existence of incipient tuberculosis in the adult. Examinations should be made at varying intervals, always employing the same technic.

Even when the clinical examination is absolutely negative, radiologic investigation may reveal important alterations, such as Assmann's infiltration, which, although it may occur in any part of the lung, shows preference for the subclavical region. In no case, however, can it determine whether this infiltration is actually the primary tuberculous lesion in the adult, or merely represents a halting place of apical foci, whether visible or not by roentgen rays, this question can be settled only at autopsy. The radiologic discovery of the infiltration is highly important as regards the early start of treatment, because its presence generally indicates the establishment of a tuberculous process.

The diversity of the statistics regarding the infiltration of Assmann and apical tuberculosis is to be attributed not alone to the nature of the material used (from dispensary or sanatorium), but also mainly to the lack of a suitable standardized radiographic technic of the thorax. The following technic is, therefore, suggested. In addition to the radio-

scope, a previous radiograph or rapid exposure at the distance of 15 meter, during the pause after inspiration, then two radiographs of the apical region, one with the technical note of Albers-Schönberg and the other with inverted incidence of the caudal side.

Radiographic examination, even the most exact, if negative, cannot exclude the existence of an apical lesion.

The statement based on radiologic findings that tuberculosis of apical origin is always less virulent, in contrast to the conception that general phthisis originates in extra-apical regions, does not as yet appear to have been demonstrated. On the contrary, Aschoff's observation that every reinfection starts with the anatomic-pathologic characteristics of an early infiltration, in whatever part of the lung, deprives the discussion of all value. On the other hand, numerous radiologic findings in genuine progressive phthisis of apical origin seems to show that this hypothesis lacks a secure basis.

The discovery of old foci in the apex is equally important, as it has been fully demonstrated that from reactivating of the same there may result genuine phthisis. Not alone the reinfection of Puhl, but also the calcified foci of Simon must be regarded as old foci. The presence of a circumscribed or of a diffused shadow should always serve to direct attention to the various possible causes of error.

The hypothesis of reinfection in the adult, with ileal origin and ascending extension, first, toward the subclavical region and then into the apex, has been demonstrated neither by anatomic-pathologic means nor radiologically, and, according to the author, rests upon an error of interpretation.

The radiologic manifestations indicating the onset of pulmonary phthisis in the adult become less frequent according as they start more posteriorly.

W W WHITELOCK, PhD

Acute Miliary Pulmonary Tuberculosis W E Hamlin *Med Bull Veterans' Administration*, October, 1931, VII, 973, 974

The author reports the case of a male, 35 years of age, who was admitted with a diagnosis of moderately advanced chronic pulmonary tuberculosis. Roentgenologic examination showed evidence of an old healed tuberculous process at the left apex, but no evidence of active tuberculosis in either lung. Seven months later the patient was discharged as absent without leave. During his stay in the hospital he gained twenty-nine pounds.

One year subsequent to his desertion he was readmitted. He had lost thirty-three pounds during the one-year period and at the time of admission he appeared ill, with a yellowish tinge to the skin.

under the pleural surface, but in these other conditions the involvement is all in one stage and not in crops, as seen in tuberculosis. The puerile and basal involvement of pulmonary tuberculosis cannot always be distinguished from other diseases. Other pulmonary diseases, likewise, may produce enlargement and calcification of the glands and thus closely simulate the glandular form of pulmonary tuberculosis, this form, however, showing evidences of caseous changes as well as calcification.

Dunham believes that miliary tuberculosis is always the result of reinfection of an old focus. This form of pulmonary disease is believed to be the result of a lack or loss of immunity. Many cases of healed miliary tuberculosis are being found in X-ray laboratories with modern technic and interpretation. The appearance is that of a fine, sharp, discrete studding, more or less evenly distributed throughout all the lobes. In the more recent cases distribution is similar, but instead of studding, there is a fine motting which has not reached the definitely calcareous stage.

J N AKE, MD

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Is diagnosis, or at least a diagnostic suspicion founded on a concrete basis, possible in the living subject in this obscure disease on which pathologic and clinical text-books have so little to say that is of a definite and helpful nature?

The author believes himself justified in replying

affirmatively to the above question, at least as regards cases not entirely obscure in etiology or rendered deceptive by a completely misleading aspect, both on the basis of a study of the literature and of a personal case in which the definite diagnosis of "primitive tuberculous splenomegaly" was later confirmed by anatomic investigation.

The present-day methods of investigations, although they have not overcome the inherent difficulties of diagnosis in the more obscure cases, show distinct advance over those of an earlier date and permit recognition of primitive tuberculous foci and signs of latent activity of the disease. In addition direct radiographic examination of the splenic tumor has been suggested for possible demonstration of calcified nodules attributable to the specific process. In this connection, however, the siderotic-calcareous nodules of the Gamma type must be borne in mind as a possible cause of the shadow. In any event, radiologic investigation serves as an adjvant to disclose the connections of the organ with adjacent viscera, and also, naturally, the presence of other plastic and calcified masses.

W W WHITELOCK, PhD

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tuberculosis in which the anatomic substratum of the connective elements is sufficiently extended and marked to constitute the predominant, if not the unique, factor of the clinical symptomatology and of the anatomic-pathologic picture of the type of pulmonary tuberculosis in question

It is indispensable for the diagnosis of this particular type of pulmonary tuberculosis to point out briefly the most important and most characteristic radiologic findings First in line must be mentioned alterations as regards shape of the skeleton, such as asymmetry, costal retractions, deviations of the vertebral column, even of very low grade, when the physico-semiology is but faintly apparent and radiologic examination proves a most valuable recourse.

The ordinary findings as regards the respiratory apparatus consist primarily of modifications in the normal transparency of the pulmonary fields in the form of more or less marked and extended opacity corresponding to the sclerotic zones In some cases it is impossible in the involved hemithorax to recognize the pulmonary outline save for brief moments At times the more or less dense shadows appear in linear form, running in the direction of the interlobular fissures There may be immobility and opacity of the costal diaphragmatic sinuses, upward stretching of the diaphragm, or pericardic-diaphragmatic adhesion, sometimes in the form of pinnae

The pulmonary field opposed to the sclerotic field may preserve its normal transparency, or even appear emphasized in cases of vicarious emphysema, or opaque zones due to pleuritic or parenchymatic processes of various types and extension may be observed

In addition to the ordinary radiologic picture pointed out above, there are certain indirect signs equally characteristic, which have been the object of special study by Italian authors (Pescatori, Casati, etc) Among these the following are worthy of special mention Deformity and displacement of the pulmonary hilus and of the interlobular fissures, the phenomenon of Rist and de Abreau, or the movement of hemithoracic balance, the phenomenon of Kienböck, the phenomenon of the mediastinal pendulum of Holzknecht and Jacobson, dislocation of the shadows of the heart and large vessels, and deviation of the images of the trachea and esophagus

As regards deformities and displacements of the pulmonary hilus and of the interlobular fissures, certain French authors speak of the elevation of the pulmonary hilus in cases of bilateral retraction of the lungs, when, on the other hand, the lesion is unilateral at the height of the corresponding hilus we have, in addition, loss of visibility of the latter through retraction of the mediastinum, whereas the hilus on the opposite side becomes free

The altered interlobular fissures may suffer im-

portant displacement by a kind of balance movement, so that they appear oblique from within outward and from below upward In roentgenograms in anterior-posterior as well as lateral projection, a peculiar fan-like arrangement of the pleural fissures may be observed, upwards or downwards according to the seat of the process of pulmonary retraction The displacements upward often cause the hilus shadow to rise to the height of the aortic arch, while in the downward displacements the hilus shadow often remains covered by that of the heart

There is stretching of the hilus also in cases of sclerosis and retraction of the interlobular pleura

The phenomenon described by Rist and de Abreau consists of the dissociation of the movements of the anterior and posterior region of the diaphragm or the hemithoracic balance movement determined by sclerosis partly localized in the anterior region of the lung This phenomenon may be observed by placing the patient in profile, when it is seen that the posterior half of the diaphragm falls normally during inspiration, while the anterior half rises slightly

In cases of displacement of the heart and large vessels toward the left, the right outline of the heart either does not appear at all, merges with the shadow of the vertebral bodies, or is found on the left among these bodies The study of the orientation of the heart and large vessels is made in a more exact manner by means of orthodiaphy in various projections, or, even better, by the method of plastic reconstruction of the heart as suggested by Palmieri In this manner, a rotation of the heart on its great axis may be stabilized, so that the point of the left ventricle is carried from the left toward the right and from the rear toward the front The aorta and the vena cava are displaced toward the right and rear, while the pulmonary cone approaches more closely to the anterior thoracic wall, moving toward the right

In one case of partial retraction observed by the author, the sclerotic process, limited to the right lobe, revealed under radiologic examination dense opacity of the upper portion of the pulmonary field, limited by the interlobular field The mediastinal shadow appeared displaced toward the right in its upper portion (trachea and great vessels), while the heart was in its normal place

W W WHITELock, Ph D

Tuberculosis of the Tracheobronchial Glands Joseph C Savage, Calif and West Med, July, 1931, XXXV, 32-34

The proper diagnosis of tracheobronchial glands is of the greatest importance to the infected child, for hilum tuberculosis not adequately treated may

Blood examination revealed a marked anemia, bronchovesicular breathing and increased whispered voice above the second rib on the right was noted on physical examination Roentgen examination showed evidence of tuberculosis in both upper lobes

After one month of hospitalization the patient's temperature began to rise, and the pulse rate increased X-ray examination at this time revealed evidence of numerous small discrete shadows of miliary size and type throughout both lung fields The patient lived for three months after the diagnosis of acute miliary tuberculosis was made

J N ANÉ, MD

A Case of Generalized Tuberculosis of the Lymph Nodes Accompanied by Appendicitis and Cholecystitis
Enrico Dotti Riv di radiol e fisica med, December, 1931, IV, 200-205

A woman, 22 years of age, came to the hospital complaining of pain in the right abdomen X-ray examination showed cholecystitis, without stone, and appendicitis

Examination brought out the fact that the patient also had tuberculosis of the cervical, axillary, inguinal, thoracic, and abdominal nodes At operation the diagnosis of cholecystitis and appendicitis was confirmed. The nodes in the abdomen were enlarged and some were calcified, others being caseated. The patient made a good recovery and is clinically well

Another interesting point brought out by this case is that notwithstanding the enormous destruction of lymphopoietic tissue, the differential leukocyte count was normal

E T LEDDY, MD

The Subapical Form of Incipient Pulmonary Phthisis G F Bume National Med Jour China December, 1931, XVII, 687-700

In 1922, Assmann published his observations on infraclavicular tuberculous infiltrations and in 1926, Redeker, who previously had devoted his studies exclusively to tuberculosis in childhood, approved the conclusions of Assmann However, before this time Wessler and Jaches, as a result of roentgen-ray studies, concluded that the earliest evidences of pulmonary tuberculosis were found far more frequently in the infraclavicular region than in the apex of the lung Assmann defined these infiltrations as "well circumscribed, round shadows of homogeneous character whose borders contrast distinctly, but without sharp outlines from their surroundings The size varies from that of a ten-cent piece to that of a one-dollar piece" The first cases were composed of students, young doctors, and young nurses, whose duties offered opportunities for reinfection Their

complaint was a slight general malaise Physical examination revealed negative results, but on roentgen-ray examination, Assmann discovered the subapical foci for the first time

While the existence and the frequent occurrence of infraclavicular infiltrations are now fairly beyond dispute, opinions regarding their origin still differ Assmann believed in a secondary, exogenous, respiratory reinfection but did not deny the possibility of occasional hematogenous reinfection Romberg and Lydtin explained the subclavicular infiltration as a perifocal reaction, either around an infected bronchial or tracheal gland, or around a parenchymatous reinfection focus in adults According to Loeschke, it begins as an exudative, bronchopneumonic affection by metastatic formation from an earlier, proliferative apical lesion As an exudative tuberculous lesion, it may be entirely absorbed and heal without leaving any vestiges It may, on the other hand, undergo fibrous transformation, encapsulation, and calcification, or it may lead to caseation and excavation, spreading into the neighboring parts of the lung

Three groups may be distinguished in regard to clinical findings The first division includes those young individuals who are exposed in their work, and who complain of malaise, subfebrile temperature, night sweats, and loss of weight A second group of cases is described as developing symptoms of influenza, with acute onset of high fever A third class of patients experiences acute and more or less profuse hemoptysis The past histories fail to reveal any symptoms suspicious of pulmonary tuberculosis On physical examination of the patients of these groups, no, or very little, evidence of pulmonary disease is found Roentgen-ray examination is generally believed to be the classical method of demonstrating these subapical lesions

Regarding the prognosis of subclavicular pneumonic lesions, it has been definitely proven that they may disappear completely, as other pneumonic infiltrations do However, the author agrees with most writers that, without therapeutic measures, progressive phthisis is the most frequent sequel

In the author's opinion all exposed persons, members of tuberculous families, students living with persons suffering from active tuberculosis, and those stricken with influenza in which the symptoms of pneumonia are absent, should be periodically subjected to roentgen-ray examination in order to demonstrate freshly infected cases as early as possible

J N ANÉ, MD

Pulmonary Tuberculous Sclerosis Achille Segal Riv d Pitol e Clin d Tuberc Dec 31 1931 V 1058-1070

From the clinical point of view we must allocate to the sclerosis group those forms of pulmonary

now occupies a position between the two extremes, ready to accept results on the basis of practical experience.

In the case of a medication of this kind, which is mainly adapted to the obtaining of partial and symptomatic results—but which are not on that account negligible—a just interpretation of the general effect is difficult, especially in view of the infinite variations presented by the disease.

In the course of five years' employment of the therapy in question, the authors observed no serious accidents More worthy of attention than the slight temporary disturbances listed are the local reactions with increase of auscultatory indications, pleural manifestations, and, at times, with accentuation of the radiologic shadows, this latter being an outstanding proof of a reaction on the part of the tuberculous granuloma The importance of these signs in the curative process cannot be disputed

In fresh and not too extended cases, radiologic *nettoyage* of the secondary disseminations may be obtained This appears so closely bound up with the aurotherapy as not to permit of doubt regarding the dissolving effects of the latter

W W WHITELOCK, PhD

Results of Roentgenotherapy in Tuberculosis of the Bones and Joints in the Surgical Clinic of the University of Kiel (1918-1927) Annemarie Dornmann Strahlentherapie, 1931, XLII, 201-218

In this paper the author discusses the results of roentgenotherapy in tuberculosis of the bones and joints, based on a survey conducted in 1929 In the first period, from 1918 to 1921, roentgen rays filtered through from 3 to 4 mm of Al and a dose of from 10 to 15 X ($E D = 25 X$) were used, in children usually only 5 X as measured with the Sabouraud-Noire pastille This dose was repeated at four-week intervals perhaps from six to eight times In some cases from ten to fifteen treatments were given during the period of from two to three years Beginning in 1922, the doses were reduced, and from 1924 on, deep therapy, with 0.5 mm Zn + 1 mm Al filtration, was employed The single dose amounted to from 20 to 30 per cent $E D$ and was somewhat lower in children All patients received general treatment as indicated in tuberculosis

In the compiled tables the patients are arranged according to the site of the lesions The disease was located in the wrist in twenty-four cases, in seven of which there was abscess formation Of the remaining seventeen, six healed with full function, three with limited function, four with ankylosis, three died, and one remained unchanged The respective figures for the seven patients with fistulae are one, two, one, two, and zero (one patient in

this group is not classified) This brings the total number of cured cases to seventeen out of twenty-four

There were twenty cases in which the ankle was involved, seven of these had fistulae Of the thirteen remaining, five healed with full function, one with limited function, two with ankylosis, three died, one grew worse, and one remained unchanged The respective figures for the seven cases with fistulae were two, one, two, two, zero, and zero In this group there were thirteen cases cured out of a total of twenty

Twenty patients with tuberculosis in the elbow joint were seen, seven of which had fistulae Of the remaining thirteen, five healed with full function, one with limited function, two healed with ankylosis, three died, one grew worse, and one remained unchanged Of the seven patients with fistulae, the respective figures are two, one, two, two, zero, and zero This means thirteen cases were cured out of a total of twenty

Forty-four patients had involvement of the knee joint, eleven of whom had fistulae Of the remaining thirty-three, twelve healed with full function, one with limited function, six with ankylosis, two were improved, eight needed operation in addition to X-ray therapy, three died, none grew worse, and one remained unchanged The respective figures for the eleven cases with fistulae are two, one, one, zero, one, three, one, and two This amounts to twenty-three cures out of a total of forty-four cases

Five patients had the process in the shoulder joint, one of whom had a fistula Of the remaining four, one healed with full function, one with limited function, one with ankylosis, and one died The one case with fistula had to be operated on There are then three cures in a total of five cases

Seventeen patients had tuberculosis of the hip joint and thirteen of these had fistulae Of the remaining four, two were cured and two died Of the thirteen cases with fistulae five were cured, three improved, four died, and one grew worse This means a total of seven cures in seventeen patients

Tuberculosis of the small bones (metacarpus, metatarsus, calcaneus, and *spina ventosa*) was seen in forty-six patients, twenty-three of whom had fistulae Of the remaining twenty-three, ten healed with complete function, one with limited function, two with ankylosis, six had to be operated on, two died, one grew worse, and one remained unchanged Of the twenty-three with fistulae, eighteen healed with full function, two with limited function, one with ankylosis, and two died In this group thirty-four were cured out of a total of forty-six

Miscellaneous cases of bone tuberculosis (ribs, sternum, long bones, clavicle) are compiled in a table of twenty-eight Sixteen of these had fistulae, of the remaining twelve, eleven were cured and one

become active and be a menace to other children. Whereas Stoloff considers only the roentgenologic examination and the tuberculin reaction to be of value in diagnosis of this condition, the author believes the history of contact with a tuberculous patient of great importance. Roentgenograms must be properly taken, in postero-anterior and straight lateral positions, and a proper interpretation must be made of these.

The National Tuberculosis Association has expressed itself as follows: "Interpretation of films should be made by an experienced physician who is familiar not only with chest films in general, but with films of children's lungs in particular. He should also have a clinical background, and the interpretation should not be independent of careful consideration of history, symptoms, and physical examination."

We have no clear understanding of what is a perfectly normal chest, because different men vary in their opinions as to the importance of the same shadows, therefore interpretation of the X-ray findings should go hand in hand with the history, the clinical, physical, and laboratory data. Most of the hilar shadows are made up of the larger vessels and not the bronchi. Normal lymph glands do not cast a shadow and cannot be recognized unless they contain calcium or encroach on pulmonary fields.

The author also discusses the clinical signs and symptoms of this condition, among which are mild disturbance of nutrition, fatigue, irritability, and a slight daily rise in temperature.

FRANCIS B SHELDON, MD

TUBERCULOSIS (THERAPY)

Arrested Pulmonary Tuberculosis Louis H Fales
Med Bull Veterans' Administration, December,
1931, VII, 1121-1127

The author considers the present classification of the American Sanatorium Association unsatisfactory in determining the existence of arrest in pulmonary tuberculosis. Considerable progress has been made since the last modification of this classification was adopted, in 1922, and suggestions of criteria of arrest are offered.

Brunn made an exhaustive study and spent considerable time in experimental work on cadavers, coming to the conclusion that râles of the most usual type heard in pulmonary tuberculosis—which occur in showers during inspiration following an expiratory cough—do not mean active tuberculosis or even tuberculosis at all. They are not due to moisture and are more of the nature of atelectatic râles. Heise, of Saranac, studied the records of 412 cases over a six-month period and demonstrated that the increase or diminution of râles in pulmonary tuberculosis was of no value in determining the patient's

progress. It is, therefore, believed that râles are of no value in determining progression and retrogression of a tuberculous lesion and that they have no place in a scheme of classification.

Latent pulmonary tuberculosis is relatively common in children and also occurs in adults. A parenchymal infiltration as seen on the roentgenogram is often the only evidence that these patients are ill. In these cases, as in those of children, if proper treatment is not instituted, the lesion usually progresses and in months or years the late manifestations will develop. Likewise, it was formerly believed that pulmonary tuberculosis could be arrested in a few months but the roentgen ray has demonstrated that, although clinical symptoms may disappear in a few months, the tuberculous lung pathology clears and fibroses very slowly, healing only after years of prolonged and continuous rest. Amberson emphasized the importance of serial roentgenograms in order to determine the progression or retrogression of the pulmonary lesions. Gerald B. Webb and McPhedran also consider the roentgen ray of utmost value, not only in diagnosis but also in determining the exact changes occurring in the lungs during treatment. The author is of the opinion that bacilli in the sputum and all constitutional symptoms that are reasonably certain to be due to tuberculosis should be absent for at least one year before the case is considered arrested. Even then, serial roentgenograms should be the deciding factor before final conclusions are reached. The roentgen-ray criteria for a healed lesion should consist of the following: (1) A stable or stationary lesion, (2) a hard, well-fibrosed lesion, (3) a lesion which has remained stationary for months. The above points should be determined by a competent roentgenologist using a proper technic and satisfactory roentgen-ray equipment.

Clinical studies have stressed the importance of complete rest and care in the inauguration of graduated exercise. After the lesion has remained hard, fibrosed, and stationary for six months, as demonstrated by serial roentgenograms, and an additional six months have elapsed with carefully graduated exercise and observation without reactivation of the disease, the case may be considered arrested.

J. N. ANÉ, MD

Indications and Results of Aurotherapy in Pulmonary Tuberculosis V De Benedetti and Felice Tocco Ria d Patol e Clin d Tuberc, Dec. 31, 1931, V, 1076-1085

After the early unjustified enthusiasm and the following inevitable distrust of aurotherapy, opinion regarding this form of treatment as in the case of other curative measures has been modified until it

now occupies a position between the two extremes, ready to accept results on the basis of practical experience.

In the case of a medication of this kind, which is mainly adapted to the obtaining of partial and symptomatic results—but which are not on that account negligible—a just interpretation of the general effect is difficult, especially in view of the infinite variations presented by the disease.

In the course of five years' employment of the therapy in question, the authors observed no serious accidents. More worthy of attention than the slight temporary disturbances listed are the local reactions with increase of auscultatory indications, pleural manifestations, and, at times, with accentuation of the radiologic shadows, this latter being an outstanding proof of a reaction on the part of the tuberculous granuloma. The importance of these signs in the curative process cannot be disputed.

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Five patients had the process in the shoulder joint, one of whom had a fistula. Of the remaining four, one healed with full function, one with limited function, one with ankylosis, and one died. The one case with fistula had to be operated on. There are then three cures in a total of five cases.

Seventeen patients had tuberculosis of the hip joint and thirteen of these had fistulae. Of the remaining four, two were cured and two died. Of the thirteen cases with fistulae five were cured, three improved, four died, and one grew worse. This means a total of seven cures in seventeen patients.

Tuberculosis of the small bones (metacarpus, metatarsus, calcaneus, and spina ventosa) was seen in forty-six patients, twenty-three of whom had fistulae. Of the remaining twenty-three, ten healed with complete function, one with limited function, two with ankylosis, six had to be operated on, two died, one grew worse, and one remained unchanged. Of the twenty-three with fistulae, eighteen healed with full function, two with limited function, one with ankylosis, and two died. In this group thirty-four were cured out of a total of forty-six.

Miscellaneous cases of bone tuberculosis (ribs, sternum, long bones, clavicle) are compiled in a table of twenty-eight. Sixteen of these had fistulae, of the remaining twelve, eleven were cured and one

died. Of the sixteen cases with fistulae ten were cured, one died, one had to be operated on, two grew worse, and two remained unchanged. This results in twenty-one cured patients of a total of twenty-eight.

Ten cases of tuberculosis of the pelvis were seen and all had fistulae, four were cured and six died.

Six cases of tuberculosis of the skull had fistulae, four were cured, one needed operation, and one grew worse under the treatment.

Of ten cases of spondylitis tuberculosa, eight had fistulae, of the remaining two, one was healed with motion, and one had a gibbus. Of the eight cases with fistulae two healed with motion, two with gibbus, two were improved, and two grew worse. There was then a total of five cures out of ten patients.

Multiple tuberculosis was seen in twenty-five patients, twenty of whom had fistulae, of the remaining five, three were cured with full function, and two grew worse. Of the twenty with fistulae, four were cured with full function, one with limited function, three were improved, four had to be operated on, seven died, and one grew worse. The end-result was, therefore, eight cures out of a total of twenty-five cases.

A grouping of the patients according to age clearly shows that the benefit derived from roentgenotherapy decreases with the age of the patient. Careful investigations were also undertaken in order to determine the percentage of roentgen late injuries. In only one case, treated in 1919, for tuberculosis of the ankle joint, was there a skin defect which discharged slightly. Pigmentation, bluish discoloration of the treated skin, and telangiectasis were seen occasionally. Disturbance of the growth in children who had been treated was very small, sometimes hardly measurable. Two cases in this group are particularly interesting, brief histories of these patients being given.

The first patient was a boy of 17 years, who underwent treatment, in 1918, because of an involvement of the elbow, the pelvis, the bladder, and inguinal glands. He received a total of 80 X over the ilium and 30 X over the gluteal region. Within nine months' time all fistulae healed and the patient could resume his work. At the re-examination, in 1929, it was found that all tuberculous processes had remained healed. The patient, who was 29 at that time, showed a definite feminine appearance in the face as well as in the body. The whole picture was very indicative of an injury to the sex glands. This was further supported by the fact that he had been married for four years without having children.

The second patient was a girl, 17 years of age, who was treated, in 1918, because of tuberculosis of the ribs. The diseased area in the region of the right breast received a total of 50 X. Re-examination November 1929 showed normal skin in the

irradiated field but an infantile right breast. Such a retardation in the development of one breast following irradiation has been described by other clinicians.

In another set of tables, the author's results are compared with those of the Surgical Clinic of the University of Rostock, where the treatment method was very similar. It appears from both statistics that a cure with complete function may be expected in at least one-fourth but not in more than one-half of all cases of tuberculous bones and joints. Late injuries are not very common, and roentgenotherapy of this disease is further recommended as an auxiliary method if applied in doses small enough to almost assure the avoidance of late injuries.

ERNST A. POHLE, M.D., Ph.D.

The Roentgen-ray Treatment of Experimental Tuberculosis John W. Spies Am. Jour. Roentgenol. and Rad. Ther., November, 1931, XXVI, 716-725

Clinical results in the treatment of skin and glandular tuberculosis by roentgen rays have been reported to be good in general, although there have been enough of unsatisfactory results obtained to stimulate laboratory investigation in an effort to further elucidate the problem of this form of radiation therapy of an inflammatory process.

The writer's laboratory material consisted of 115 guinea pigs and eight rabbits injected with varying amounts of a very virulent and a scarcely virulent strain of tubercle bacilli. Sixty-nine of the guinea pigs and four of the rabbits were irradiated according to four different plans, the remaining animals, used for controls, were inoculated but not irradiated. Effects of radiation were essentially negative, except that guinea pigs irradiated the day of inoculation exhibited acceleration of the disease in the form of ulcers and abscesses at the site of injection and regional lymphadenomegaly, although duration of life and extent of lesions at autopsy were not affected. Animals submitted to repeated irradiation prior to inoculation developed local evidences of the disease more slowly but showed no differences in the later stages of the disease.

Histologic findings were as follows. Slight increase of connective tissue at the site of irradiation, rarity of giant cells, presence of both caseous and proliferative forms of tubercles, and a proliferative hepatic cirrhosis.

The above findings offer by no means a complete answer to the clinical problems presented, for, admittedly, until a chronic tuberculous lymphadenopathy can be successfully produced in a laboratory animal, a carefully conducted evaluation of the results of roentgen therapy in this form of inflammatory disease cannot be made.

J. E. HADDE, M.D.

Phrenic Exeresis in the Treatment of Unilateral Pulmonary Tuberculosis George M Landau Illinois Med Jour, LX, November, 1931, 408-412

This article is based on a ten-year experience as radiologist at the Cook County Tuberculosis Hospital, during which time, between 15,000 and 20,000 films have been studied.

If the results of operative procedures show that surgery has great value in the treatment of pulmonary tuberculosis, as an adjunct to sanatorium treatment, then there is every reason to justify the enthusiasm following the results of such treatment.

The writer says that if we can show by our records cases of clinical cure or arrest, such as the following, then this procedure must merit our attention. The patient, a physician without previous symptoms, had a severe hemoptysis, X-ray examination showing a large cavity in right lower lobe. Positive sputa and high temperature continued in spite of bed rest. Repeated X-ray examination revealed an increase in size of cavity and lower lobe mottling. Right phrenic extraction was done and immediate improvement noted, less sputa, drop in temperature and decrease in size of the cavity. In three months, a gain of 25 pounds in weight, normal temperature, negative sputa, absence of mottling, and practically complete obliteration of the cavity resulted.

In the program as carried out by Otto Schlack and Jerome Head, there has been no operative morbidity or mortality and no patient has been made worse by the treatment.

In conclusion the author states "It is probably not within the province of the radiologist to draw conclusions or elucidate on the indications and contra-indications to phrenic exeresis other than those conclusions which he deduces from the roengenogram itself, but certainly after following such a series of studies of such cases as we have, one cannot help but conclude that in a disease as serious as pulmonary tuberculosis and in which such an agent as this has proved of such great therapeutic value, I do not see how one can escape the conclusion that this remedy should be applied as completely and effectually as possible, regardless of the fact that the patient may get well without it."

CHARLES H DEWITT, M D

The Treatment of Tuberculosis of the Female Genital Organs H Martius Strahlentherapie, Oct 24, 1931, XLII, 471-484

This is a detailed discussion of the author's indications concerning the treatment of tuberculosis of the female genital organs. Operation is contraindicated if other organs, as, for instance, the lungs,

are also involved. In some cases operation is necessary, because a diagnosis can be made definitely only after laparotomy. The use of small doses is urged in order to maintain the ovarian function. From 60 to 110 r are suggested as a single dose, the intervals and frequency of the treatments being adapted to the individual case. The exact mechanism of the effect is not definitely known. From the author's own statistics it appears that, of thirty-five cases treated during the years from 1917 to 1923, fifteen died, fifteen were cured, and five improved. Of twenty-two cases seen during the years from 1924 to 1930, one died, twelve were cured, five improved, and four have not healed so far.

ERNST A POHLE, M D, Ph D

Successful Radiotherapy of Two Cases of Pelvic-peritoneal Tuberculosis in Women M Mathey-Cornat Bull et Mem de la Soc de Radiol Méd de France, June, 1931, XIX, 297-300

The first case, a female, 34 years of age, had "intestinal grippe," in March, 1930, with rapid pulse and fever from 38° to 40° C, lasting for ten days, with loss of appetite, asthenia, vomiting. In April, 1930, all symptoms subsided except fever, tenderness in the lower abdomen, diarrhea, and fetid feces, and anemia with leukorrhea. Examination showed an abdominal pelvic tumor mass of the uterus and adnexal masses, adherent, diagnosed as bilateral pyosalpinx, either of gonococcic or tuberculous origin. Laboratory tests for gonococci were negative. Two series of X-ray therapy in May and July, 1930, were given, totalling 1,600 and 2,000 roentgens, respectively, in divided dosage. The tumor receded in size, diarrhea ceased, and pelvic pain was less. The temperature became normal. Normal menstruation reappeared in January, 1931, and by May, 1931, she appeared perfectly well, with slight local tenderness in the lower abdomen only.

The second case, a female 26 years of age, began having irregular and excessive menstruation with pelvic pain, in March, 1926. She was hospitalized in October, 1926. In July, 1929, a sero-fibrinous pleurisy developed on the left side, requiring thoracentesis on two occasions. The fever ranged from 39° to 39.5° C. Pelvic examination revealed bilateral adnexal masses the size of two chestnuts, fixed, with a fibro-ascitic fluid in the left iliac fossa. In July, August, and September, 1929, three series of X-ray treatments were given, totalling 4,000 roentgens at each series through three portals of entry, each lateral port receiving 1,600 roentgens and the central port 800 roentgens, using 180 peak kilovolts (filtration not stated). By January, 1930, the uterus had become partly mobile, the adnexal masses had practically disappeared, and the fever had subsided. By August, 1930, all abdominal pain

had ceased. In May, 1931, no local signs could be found as sequelæ of the tuberculous pelvic peritonitis, and examination of the lungs was negative.

CHARLES S CAPP, M D

The Treatment of Empyema Carl A Hedblom
Jour Am Med Assn, Dec. 26, 1931, XCVII, 1943-1950

Empyema may be classified as pyogenic and tuberculous, the pyogenic being subdivided into the acute and chronic, the tuberculous practically always becoming chronic.

The pneumococcus, streptococcus, and staphylococcus are the most common infective organisms in the order named. Empyema cavities vary greatly as to position and size. Bronchial fistulae may result from rupture of a pulmonary abscess into the pleural cavity, or from perforation of an empyema into a bronchus.

Differentiation of types depends essentially on examination of smear and culture for pyogenic organisms. Treatment differs radically. The fundamental principle of treatment is drainage, instituted early, by a method that will not embarrass respiration or circulation and maintained until the cavity is obliterated.

Closed drainage is the method of choice in all early acute cases, in severely ill patients, and in infants. Rib resection and pus drainage is the alternative method and the method of choice in cases with large bronchial fistulae.

Drainage is contra-indicated in sterile tuberculous empyema. Without associated pulmonary tuberculosis, air is substituted for the pus. With associated active pulmonary tuberculosis, pneumothorax is continued. If pus continues to form, a plastic obliteration of the cavity is brought about, as for the non-tuberculous type.

C G SUTHERLAND, M D

TUMORS (DIAGNOSIS)

Encephalography and Ventriculography W Löffler
Schweiz med. Wehnschr., Aug 29, 1931, LXI, 816-824

Thirty-six cases have been studied, eight of which involved the region of the hypophysis. Of the four methods, direct puncture of the lateral ventricle and cisterna puncture are most used. The author injected a little air in an effort to produce a minimum of trauma. The technic is described.

Patients with extreme hydrocephalus, Parkinson's disease, and encephalitis lethargica stand the examination well, but untoward symptoms may arise in

patients who have brain tumors. The author describes the complications. Good transient therapeutic results were obtained in some cases.

Seven cases of tumor of the hypophysis are reported. The findings are differentiated by Stenvers from those of hydrocephalus of the third ventricle by the more regular encroachment on the sella, seen in the hypophyseal tumors. The author found that the "regular" type of encroachment was common to four benign tumors, whereas in four malignant tumors there was an irregular enlargement of the sella with little or no hydrocephalus, but compression of the lateral and third ventricles.

H C OCHSNER, M D

Irradiation as a Means of Differentiating Certain Varieties of Tumors A U Desjardins Med. Clin. North America, November, 1930, XIV, 619-638. (Reprinted from "Cancer Review" by permission.)

The author points out that the radiologist can frequently distinguish between different tumors by the rate and extent of their regression after irradiation. In some cases, such as the lymphoblastomas and embryonic testicular carcinoma, this means of differentiation has proved to be nearly as accurate as histologic examination. He discusses, in addition to lymphoid and testicular tumors, bone tumors, and cites cases in support of his contention.

F CAVERS, D Sc.

Xanthomatosis (Schüller-Christian's Disease, Lipoid Histiocytosis) Merrill C Sosman Jour Am Med Assn, Jan 9, 1932, XCVIII, 110-117

Xanthomatosis is a disease of lipid metabolism in which storage tumors of lipid appear in various places and in various organs, sometimes profoundly affecting the bodily health and welfare. There are five clinical entities included under this heading, namely, Gaucher's disease, Niemann-Pick's disease, Schüller-Christian's disease, the xanthomas occurring in icterus, diabetes, and pregnancy, and the so-called essential xanthomatosis.

Schüller-Christian's disease occurs chiefly in young children; it is characterized by involvement of the bones of the skull (occasionally other bones), with frequent association of diabetes insipidus, exophthalmos and gingivitis, less commonly dwarfism, adiposogenital dystrophy, and jaundice; it is not racial or familial, and is fatal in about one-third of the cases. Histopathologic studies have demonstrated that we are dealing with a phagocytic action of the reticuloendothelial system, which either removes an excess of lipoids from the tissues, or stores an excess of

lipoids in areas in which trauma or infection may have stimulated a collection of histiocytes. Chemical studies have proved that different lipoids are at fault in the different diseases. These cases are reviewed. Treatment includes diet and the administering of endocrine glands or their extracts. Schuller-Christian's disease is liable to spontaneous remission. Roentgenotherapy has given a uniformly beneficial result as far as local deposits in the bones are concerned. Recurrences may take place in the same place or in other bones.

C G SUTHERLAND, M D

Malignant Giant-cell Tumor of Radius with Recurrence and Metastasis Report of a Case H Kokita Chinese Med Jour, January, 1932, XLVI, 64-68.

The author reports the case of a Chinese woman, 47 years of age, who presented a tumor of the right wrist of one year's duration. Physical examination revealed nothing of importance except the local condition. The tumor, which involved the distal third of the forearm, was firm and slightly tender on palpation. X-ray examination revealed bone destruction of the distal third of the radius, with expansion of the cortex. The expansion, however, was not symmetrical, as the radial side of the expanded shell remained intact and served as a connection between the undestroyed articular surface and shaft. At operation, the tumor was excised and a portion of the fibula transplanted. Pathologic examination of the specimen revealed a malignant giant-cell tumor, with no regularity in size and shape of the cells and with many mitotic figures.

Five months after operation the patient returned with a recurrent tumor. The growth was irregular in shape and had four firm prominences covered with shiny, tense, bluish-red skin which in places discharged a serosanguineous thin fluid. Roentgenograms revealed complete destruction of the distal third of the ulna and extensive destruction of the middle and remaining distal third of the radius. The bone graft was apparently not involved in this process. Metastases were found involving several ribs, both pleura, and the base of the right lung. The arm was amputated and the metastatic lesion involving one of the ribs was removed. The patient died several months later.

The author discusses the importance of considering the two different elements found present in giant-cell tumors. These are giant cells and the stroma. The characteristic feature of the tumor is the presence of numerous giant cells, which, however, play a very insignificant rôle when the question of malignancy is considered. The activity of the tumor depends primarily upon the stroma cells. In the majority of giant-cell tumors the stroma cells are

mature, fibroblastic cells, which are uniform in size, spindle shaped, and contain no mitotic figures. These tumors are essentially benign. There is, however, a small number of cases which, though indistinguishable from benign giant-cell tumor clinically, roentgenologically, and according to their macroscopic morphology, show a significantly different microscopic picture. The difference here lies in the microscopic appearance of the stroma cells, for the giant cells are similar in appearance in these two types of tumors. In the malignant type, the stroma cells appear immature, irregular in size and shape, and show active mitosis, which is a definite indication of rapid growth and malignancy.

J N ANE, M D

The Triad of Symptoms in the Diagnosis of Intrathoracic Tumors Guillermo Bosco Rev Med Cubana, January, 1932, XLIII, 99-103

The aim of this article is to point out the importance of a triad of symptoms which simplifies the diagnosis of intrathoracic neoplasms. Without this triad the internist relies on the roentgenologist for diagnosis when even the latter is unable to give a positive diagnosis. To help out in this difficulty the author offers the following triad of symptoms:

(1) *Thoracic Pain*—According to the writer this sign has triple meaning and is a constant symptom. It is intense in character, constant, and radiating. This pain is so intense that even rest has no influence over it, being relieved by active medication only. Obviously, the relief lasts only while the medicinal effect endures. The pain, so intense that no other condition simulates it, is usually found anterior to the growth. The radiation has an almost localizing character. Lesions of the superior lobe radiate their pain to the head, neck, shoulder, and arm. Lesions of the middle lobe radiate their pain, together with lesions of the inferior lobe, along the thoracic wall. This is due to the fact that these lesions affect the intercostal nerves.

(2) *Homolateral Contortion*—The author calls attention to a finding which he has observed in patients having intrathoracic tumors. This sign—a homolateral bending of the entire trunk toward the affected side—is best observed when the patient is in the upright position and all the clothing has been removed. Some patients may become conscious of this deformity and try to correct it while being examined. If this does not happen, the finding, which the author attributes to a muscular rigidity caused by the lesion, is quite constant.

(3) *Tumor Shadow on the X-ray Film*—This shadow resembles that of any thoracic neoplasm. It is dense in consistency, irregular in shape (depending on its length of growth), with a sharp or hazy border. It is difficult and at times even impos-

sible to say whether it is benign or malignant. The author, through an original observation, claims that he can tell whether a growth is malignant or not. He combines a detailed history, a complete physical examination, and X-ray plates made at different angles. According to his observation, all malignant neoplasms adhere to the mediastinum. This sign is present, irrespective of the density, shape, or size of the neoplasm.

JOSEPH MALDONADO, M.D.

A Statistical Review of Tumors of the Locomotor Apparatus Observed in the Istituto Ortopedico Rizzoli during the Years 1929 and 1930 Giulio Faldini and Oscar Scaglietti Riv di radiol e fisica med., December, 1931, IV, 179-199

This review is of thirty-three cases of tumor seen in Rizzoli's institute during 1929 and 1930, which, according to the classification of Putti and Camurati, fall into the following groups. Tumors of the soft parts, three; osteogenic sarcomas, nine; giant-cell tumors, six; metastatic tumors, eleven; benign tumors, three; and myeloma, one.

Thirteen of these were diagnosed histologically, and the remaining twenty by clinical and radiographic data. Four of the metastatic tumors came from an undiscovered primary.

The clinical histories, the treatment, the radiologic and the pathologic findings in these cases are given in outline. The report is given to supplement the other studies of the material coming to the Institute.

E. T. LEDDI, M.D.

Pituitary Tumor Causing Trifacial Neuralgia Eugene F. Bogen Med Bull Veterans' Administration, November, 1931, VII, 1067-1069

The author reports the case of an ex-service man, 35 years of age, who complained of neuralgia and nervousness of long standing. Physical examination of the patient revealed coarse features and a broadened nose. The hands were immediately noticeable because of their large size. The blood Wassermann and urine examinations were negative. A special examination of the eyes revealed cupping of the left optic disc. Stereoscopic roentgenographic examination of the skull showed erosion of the anterior and posterior horns of the ethmoid processes and of the floor of the sella turcica. This was considered suggestive of brain tumor.

From the clinical and X-ray findings the diagnosis of acromegaly, due to pituitary gland tumor, and trifacial neuralgia, due to pressure of the tumor on the trifacial nerve, was made.

While trifacial neuralgia resulting from the pressure of a tumor on the trifacial nerve or its ganglion

is not common in occurrence, the author believes that in cases of persistent trifacial neuralgia, in which no adequate local cause can be found, the possibility of a tumor producing pressure on the nerve or its ganglion should be considered and the patient referred for a radiologic examination.

J. N. ANÉ, M.D.

Sarcomatous Epulis Attributed to Irritation by Broken Nerve-extracting Needle. A Catterina. Clin Chir, November, 1930, XXXIII, 1292-1306 (Reprinted from "Cancer Review" by permission)

A girl, 19 years of age, was treated for caries of a central upper incisor by a dentist who inserted a peg tooth. Ten months later a soft tumor was seen at the gingival border between the central incisors. X-ray examination showed that from the apex of the root, which was perforated by the metallic peg tooth, about 1 cm of a nerve-extracting needle projected into the alveolus. The tumor was removed and found to be spindle-celled fibrosarcoma. Four months later there was recurrence, a second and more radical operation was performed, but the patient died three months after this, owing to orbital invasion and cerebral metastases.

F. CAVERS, D.Sc.

Malignant Adenomas of the Colon. E. J. Kilfoyle Am Jour Surg, August, 1931, XIII, 283-290 (Reprinted from "Cancer Review" by permission)

The author discusses adenomas of the colon and reports an unusual case in which multiple adenomas of the large and small variety have undergone malignant changes. The polyps vary in size from a simple hyperplasia to tumors 5 or 6 cm in diameter and with pedicles up to 6 cm in length. Recurrence took place at the site of the old operation and about the colostomy opening, as a result of transplanted tissue from the Mikulicz resection and not removing enough of the colon. The tumor increased in spite of vigorous diet and X-ray treatment.

In a very large percentage of cases single adenomas are malignant, while in the multiple type they may become malignant if they increase in size sufficiently to undergo malignant changes. Adenomas occur most frequently in the large bowel. They occasionally are seen in the small bowel, and may be found throughout the gastro-intestinal tract. All adenomas are potentially malignant, and the type of operation and post-operative treatment should be left to the surgeon and to the nature of the individual cases. Adenomas in the colon and secondary implants in the abdominal wall are very resistant to

deep X-ray therapy. Malignant changes begin in the periphery of the larger polyps, rarely occurring in the smaller ones.

W T WARWICK, MA

Sarcoma of the Lacrimal Region in an Eleven-year-old Child. N Puente Duany, A Oteiza, and E. Fonts Boletin de la Sociedad Cubana de Pediatría, June, 1931, III, 217-220

This case is here presented because of its being so rare. A child eleven years old, four months previous to admission to the hospital, noticed a small nodule in the median angle of the right eye, which grew gradually without affecting the child in any visible way. On admission, the lesion was found to be about the size of a Brazil nut, ulcerative, painless, and firm, with a sero-sanguineous fluid and very sharp edges. A radiograph failed to reveal any bone changes around the lesion. At biopsy, the diagnosis of sarcoma was reaffirmed. Treatment consisted of X-ray therapy.

N G GONZALEZ, MD

Cerebral Tumor as a Cause of Generalized Epileptic Attacks of Long Standing. E A Blake Pritchard Lancet, Oct 17, 1931, CCXXI, 842-844

The author presents five cases which show that it is possible for a cerebral tumor to give rise to generalized convulsions and to status epilepticus for many years before localizing signs are present. In general, such tumors are slow-growing and originate beneath the cerebral convolutions.

Epileptic attacks cannot be regarded as resulting from a rise in intracranial pressure, since, as shown in his cases, they may be present for many years before other signs of an increased intracranial pressure are manifest. Nor does an increase in intracranial pressure later increase the frequency of epileptic attacks.

Inference, from these considerations, is drawn that persons of middle age, who develop convulsions which occur repeatedly, should be regarded as possibly having an intracranial tumor and should be kept under repeated observation.

F L GRANDSTAFF, MD

Two Cases of Oligodendrogloma, with Remarks on the General Clinical Features of Such Cases. J Purdon Martin Brain, 1931, LIV, Part 3, p 330-349

The author reports two cases of oligodendrogloma in detail and also reviews a number of the cases which have been reported in the literature.

He states that in 16 of the 19 cases reported in the literature, the tumor lay laterally in the cerebral hemisphere where it did not interfere directly with the circulation of the cerebrospinal fluid. Fourteen of these tumors were situated in the frontal or parietal lobes, and one each in the temporal and occipital lobes. In three cases the tumor lay across the midline of the brain and had no calcified deposits. All of the tumors which were situated laterally in the hemispheres contained sufficient calcium to be seen in the roentgenogram.

The author states further that the differential diagnosis of the nature of the tumor by means of the shadow is not possible because the calcareous deposits lie chiefly in the walls of the arteries and capillaries.

CORNELIUS G DYKE, MD

Capillary Hemangioma of Cerebrum. W G Barnard and F M R Walshe Jour Path and Bacteriol, May, 1931, XXXIV, 385-387

These tumors are so rare above the tentorium that eminent authorities doubted their existence. A case is here reported with post-mortem findings.

E C VOOGT, MD

Necrotic Angioma. L E Pierini and P Beranger Rev de Especial, October, 1930, V, 1411-1413 (Reprinted from "Cancer Review" by permission.)

An angiomatic tumor on the face of an eight-day-old infant showed areas of necrosis, with destruction of the skin over the cheeks, of the lobes of both ears, of the left nostril, and of the nasal septum. The authors administered salvarsan (though there were no signs of syphilis or other infection), methylene blue, and deep X-rays, but these were all unavailing.

F CAVERS, D Sc

TUMORS (THERAPY)

Bladder Tumors Clinical Manifestations Report of Cases. Louis Clive Jacobs and Abelson Epstein Calif and West Med, September, 1931, XXXV, 207-212

In the diagnosis of bladder tumors, the authors find that cystographic findings have not received the attention and importance they deserve. Cystoscopic inspection should and can be supplemented by cystography but can never be superseded by it. Cystograms should corroborate the cystoscope, but many times because of tumor mass, hemorrhage, vesical detormity, etc., the cystoscope is useless. Cysto-

grams give not only evidence of the size of the tumor but also knowledge of ureteral reflux with secondary ascending kidney infections and evidence of metastases of the bones. Where one finds general carcinomatosis, he will refrain from futile bladder surgery.

Under discussion of treatment, the authors cite fulguration, diathermy, radium, deep X-ray, and resection. They discuss all these various methods of treatment. While they have used radium and deep X-ray therapy on some patients, they are not able to see any brilliant results. In statistics compiled from fifty patients, they find they have five alive and free from symptoms at the end of four years. Of these, four were treated by surgical diathermy alone and one with diathermy and radium. Also, they have three patients treated by transurethral fulguration, in 1916, one of whom had a recurrence with metastasis after eight years. The other two are alive, although one had a recurrence three years ago and again one year ago, the other has had no recurrences. This article is illustrated with several cystograms.

FRANCIS B. SHELDON, M.D.

An Advanced Case of Nasopharyngeal Fibroma Treated by Diathermy Coagulation and X-rays
H. V. Forster Jour Laryngol and Otol, June, 1931, XLVI, 402-404 (Reprinted from "Cancer Review" by permission)

A male, aged 19, was found to have a large polypoid growth completely obstructing the left nasal passage. It bled very freely, even with slight interference, and there appeared to be no doubt but that the tumor was a nasopharyngeal fibroma. The tumor appeared to be invading the maxillary antrum.

A small dose of radium was given without any definite result. Three diathermy operations were then carried out, and as a result the tumor decreased in size. There was a tendency, however, to swelling of the left pharyngeal wall and left tonsil, and palpation suggested advance of the growth over the roof of the nasopharynx. Deep X-ray therapy was then administered and produced immediate improvement, which has been maintained up to the time of publication. Professor Regaud had expressed the opinion that nasopharyngeal fibromas were insensitive to radiation.

P. J. KERLEY, M.B.

Roentgenotherapy in Tumors of the Hypophysis
Karl Frik. Strahlentherapie, Oct 24, 1931, XLII, 437-452

The author reports six cases of hypophyseal tumor which were treated by roentgen rays. The first

case was that of a man, 61 years of age, whose symptoms started two years before he came to the clinic. He had attacks similar to epilepsy, and suffered from loss of memory and insomnia. Besides, there were acromegaly, polydipsia, and polyuria as well as disturbances of the vision. Following two series of deep therapy the acromegaly remained stationary, he had no further attacks, much less headache, and there was considerable improvement of the polydipsia and polyuria. This improvement has lasted, so far, for one and one-half years.

The second case was that of a man, 38 years of age, whose symptoms had begun eighteen months before. He had headache, disturbance of vision, polyuria, and acromegaly. Already, after one series of treatments, he was so much improved that he could resume his work as a taxi driver. Six months later the headache recurred but disappeared following a second series. He has been well now for one year and five months.

The third case was that of a man, 47 years of age, whose symptoms dated back one-half year. He had symptoms in the eyes, headache, right arm paresis, left temporal hemianopsia. The pathology in the right eye could not be influenced and that in the left remained unchanged for a long time. The headache was, however, improved following the first series of treatments. Definite improvement in the left field of vision occurred recently, over two years following the treatment and after five series. The improvement still remains now, three and one-half years after the first exposure. The recurring headache could be eliminated by a sixth series of treatments, two and one-half years before the date of this report.

The fourth case was that of a man, 40 years of age, who had his first symptoms two years before the treatment. His principal disturbances were of vision and memory. Roentgenologically a hypophyseal tumor could be demonstrated. Biopsy showed adenoma. Four weeks after the first series of treatments he could resume his duties as a police sergeant. The improvement lasted for one-half a year, during which time a second series was given. Headache, vertigo, and disturbances of the vision could be improved by a third series, and the patient has remained able to work for one year and three months.

The fifth case, a man, 39 years of age, had symptoms for a year and a half, with a preponderance of disturbances of the vision. Roentgenologically, there was a large hypophyseal tumor, with destruction of the neighboring tissue. Biopsy showed adenoma. After one series of treatments there was considerable improvement and after a second series the patient resumed his work and has been well now for two years.

The sixth case was that of a woman, 65 years of age, with symptoms for only three months. The chief complaint was that of loss of eyesight. This

was accompanied by loss of hair and diabetes insipidus Roentgenotherapy led to a clinical cure which has lasted now for two years Deep therapy radiation was used (178 KV, 6 m_r, 06 mm Cu, 6 X 8 sq cm field, 40 cm FSD) Four fields were usually exposed, two temporal, one frontal, and one occipital, sometimes also a parietal area The average dose per field was 75 per cent H.E.D Slight changes in the technic were made, according to the requirements of the individual case

From his observations, the author concludes that radiation therapy should be regarded as the method of choice in cases with hypophysial tumors If there is no response following the first series, treatment should not be discontinued unless there is a vital indication for operation Caution is indicated in prescribing the dose, fractional irradiation being preferable

ERNST A POHLE, M D, Ph D

Laryngeal Fibrosarcoma. Deep X-ray Treatment Five-year Cure V Texier Ann Mal Oreille, August, 1930, XLIX, 823, 824 (Reprinted from "Cancer Review" by permission)

The patient was a man, 77 years of age, who had for five years been hoarse and lately almost voiceless A small, smooth tumor sessile on the right cord, which was thickened and infiltrated, was removed almost completely and found to be a fibrosarcoma with large spindle cells The treatment was given in seventeen sittings of one hour each, 2 ma, 25 cm distance, 15 mm Al (dosage not stated) After more than five years of freedom from recurrence, the patient died from enteritis

F CAVERS, D Sc

ULCERS (ETIOLOGY)

Ulcers of the Rectum and Sigmoid The Differentiation of Tuberculous Ulcers from Amebic Ulcers, and Chronic Ulcerative Colitis Clement L Martin Jour Am Med Assn, Jan 2, 1932, XCVIII, 27-31

Outside of institutions for the tuberculous, tuberculous ulcers of the rectum and sigmoid are infrequently observed Even in institutional patients they are uncommon, except in those with far-advanced disease Chronic ulcerative colitis and amebiasis with ulceration are the more common lesions seen in ordinary practice The proctoscopic differentiation of tuberculous ulcer, chronic ulcerative colitis, and amebic ulcers is given in detail One case is reported in which pulmonary tuberculosis and chronic ulcerative colitis were co-existent

A negative roentgenogram of the chest and the absence of positive lung findings exclude tuberculosis in the etiology of multiple ulcers in the rectum and sigmoid

C G SUTHERLAND, M D

A Case of Post-operative Gastroduodenal Ulcer Treated Medically, with a Clinical and Radiologic Cure. Dino Agati Archivio di Radiologia, May-June, 1931, VII, 509-524

In a case of pyloric stenosis which had had a posterior gastro-enterostomy by the method of V Hacker, the author found the complete clinical and radiologic findings of secondary gastroduodenal ulcer The patient was treated medically and ten months later he was completely cured The niche and the other direct and indirect signs of ulcer had disappeared

E T LEDDY, M D

Diagnosis of Peptic Ulcers Sam A Overstreet Kentucky Med Jour, August, 1931, XXIX, 394-396

Out of 407 patients with stomach complaints, on X-ray examination, 67 showed peptic ulcer In very many cases the X-ray examination indicated lesions in other organs, and the exclusion of peptic ulcer is frequently just as valuable a discovery as finding one

W W WATKINS, M D

ULTRA-VIOLET LIGHT

Contribution to the Study of the Path of Penetration of the Anti-rachitic Influence of Ultra-violet Rays on the Organism Gino Frontali La Radiologia Medica, November, 1930, XVII, 1316-1333

In order to establish whether or not the curative and preventive action of ultra-violet rays takes place through the inhalation of irradiated air or through direct exposure of the skin, the author selected three groups of albino rats, fed according to McCollum's diet No 3,143 and submitted to the following living conditions The first group was allowed to breathe temporarily irradiated air, from 5 to 120 minutes, in glass vessels from which they were removed without having been directly exposed to the rays, the second group was submitted to direct ultra-violet treatment and inhalation of irradiated air was totally excluded, the third group was given no ultra-violet treatment of any sort Results were founded on radiologic, histologic, and general examinations

grams give not only evidence of the size of the tumor but also knowledge of ureteral reflux with secondary ascending kidney infections and evidence of metastases of the bones. Where one finds general carcinomatosis, he will refrain from futile bladder surgery.

Under discussion of treatment, the authors cite fulguration, diathermy, radium, deep X-ray, and resection. They discuss all these various methods of treatment. While they have used radium and deep X-ray therapy on some patients, they are not able to see any brilliant results. In statistics compiled from fifty patients, they find they have five alive and free from symptoms at the end of four years. Of these, four were treated by surgical diathermy alone and one with diathermy and radium. Also, they have three patients treated by transurethral fulguration, in 1916, one of whom had a recurrence with metastasis after eight years. The other two are alive, although one had a recurrence three years ago and again one year ago, the other has had no recurrences. This article is illustrated with several cystograms.

FRANCIS B. SHELDON, M.D.

An Advanced Case of Nasopharyngeal Fibroma Treated by Diathermy Coagulation and X-rays
H. V. Forster Jour Laryngol and Otol, June, 1931, XLVI, 402-404 (Reprinted from "Cancer Review" by permission)

A male, aged 19, was found to have a large polypoid growth completely obstructing the left nasal passage. It bled very freely, even with slight interference, and there appeared to be no doubt but that the tumor was a nasopharyngeal fibroma. The tumor appeared to be invading the maxillary antrum.

A small dose of radium was given without any definite result. Three diathermy operations were then carried out, and as a result the tumor decreased in size. There was a tendency, however, to swelling of the left pharyngeal wall and left tonsil, and palpation suggested advance of the growth over the roof of the nasopharynx. Deep X-ray therapy was then administered and produced immediate improvement, which has been maintained up to the time of publication. Professor Regaud had expressed the opinion that nasopharyngeal fibromas were insensitive to radiation.

P. J. KERLEY, M.B.

Roentgenotherapy in Tumors of the Hypophysis
Karl Frik. Strahlentherapie, Oct 24, 1931, XLII,
437-452

The author reports six cases of hypophyseal tumor which were treated by roentgen rays. The first

case was that of a man, 61 years of age, whose symptoms started two years before he came to the clinic. He had attacks similar to epilepsy, and suffered from loss of memory and insomnia. Besides, there were acromegaly, polydipsia, and polyuria as well as disturbances of the vision. Following two series of deep therapy the acromegaly remained stationary, he had no further attacks, much less headache, and there was considerable improvement of the polydipsia and polyuria. This improvement has lasted, so far, for one and one-half years.

The second case was that of a man, 38 years of age, whose symptoms had begun eighteen months before. He had headache, disturbance of vision, polyuria, and acromegaly. Already, after one series of treatments, he was so much improved that he could resume his work as a taxi driver. Six months later the headache recurred but disappeared following a second series. He has been well now for one year and five months.

The third case was that of a man, 47 years of age, whose symptoms dated back one-half year. He had symptoms in the eyes, headache, right amaurosis, left temporal hemianopsia. The pathology in the right eye could not be influenced and that in the left remained unchanged for a long time. The headache was, however, improved following the first series of treatments. Definite improvement in the left field of vision occurred recently, over two years following the treatment and after five series. The improvement still remains now, three and one-half years after the first exposure. The recurring headache could be eliminated by a sixth series of treatments, two and one-half years before the date of this report.

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Many of the radio-active substances sold to the public may be dangerous to health. The drinking of radio-active waters, containing radon, over long periods of time should be discouraged. Martland likewise cautions against the intravenous injection of long-lived radio-active elements.

C G SUTHERLAND, M D

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The author discusses the subject from these four standpoints and urges co-operation between the attending physician and the specialist in the examination of the eye, ear, nose, and throat, the gums and teeth, and in the interpretation of X-ray findings, in making a complete diagnosis and outlining a complete treatment.

Simply finding a focus of infection and removing it is not sufficient. By the time a patient consults his physician the effects of a focal infection are seldom restricted to the focus itself. In the treatment of a patient with a badly infected tooth or tonsil, it is not simply a question of its removal. A more important question is the possible existence of systemic disease or metastatic infection, either the result of the focus or co-existent with it. The specialist should call in the physician and the two should co-operate in the search for all the avenues of disease. Only the combined treatment of all the phases of the disease in the individual patient can bring satisfactory results. And only the careful follow-up of the patient can guard against future ill-results not possible of anticipation at the time of the original treatment. An incomplete recovery is always an indication that some avenue of disease has been unexplored at the original date of treatment, and re-investigation is required.

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L MARINELLI

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H von Euler and B Jansson Arkiv Kemi Min
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Many of the radio-active substances sold to the public may be dangerous to health. The drinking of radio-active waters, containing radon, over long periods of time should be discouraged. Martland likewise cautions against the intravenous injection of long-lived radio-active elements.

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J E HABBE, MD

Roentgenologic Studies at the Bedside Walter H Ude. *Journal-Lancet*, Aug 15, 1931, LI, 521-528

While bedside roentgenographic work finds its widest application in the study of the bony framework in connection with fractures, the method has other uses also. Very satisfactory chest films can be made, though fine detail is lost because of time of exposure required, but in cases of pneumonia, pleural effusion, or post-operative complications, it is very valuable. Bedside films of the abdomen may be of great help, especially where bowel obstruction is suspected. Several other types of lesions can often be advantageously examined with the bedside unit.

W W WATKINS, M D

Blood Cultures and Focal Infections An Experimental Study with One Hundred Healthy Adults Gordon C Cameron, C A Rae, and George N Murphy *Canadian Med Assn Jour*, August, 1931, XXV, 131-134

The fact that the blood stream of the healthy animal is normally free of bacteria is such a fundamental in our conception of infection that we accept it with little more than a passing thought. It is noteworthy, however, that records of studies to establish this fact are very difficult to find. Our assumption is based upon the fact that in ordinary practice we obtain many negative cultures of blood and when we do encounter positive cultures they are usually of serious import. There is much evidence, however, to indicate that pathogenic organisms do invade the blood stream without necessarily indicating disaster and without the production of significant symptoms. It is felt that one of the most definite indications of this is the frequent occurrence of osteomyelitis of a suppurative type from which staphylococci are obtained and which could result only from hematogenous infection. Also, the not infrequent experience of finding staphylococci or similar micrococci in blood cultures in hospital laboratory practice leaves one in doubt as to whether these organisms are contaminants or potential pathogens. Then, too, one encounters other organisms variously described as "diphtheroids" and "pleomorhic non-hemolytic streptococci," which do not induce disease of serious import.

In view of these considerations it was felt that information might be obtained by performing blood cultures on a large group of persons in good health. This report, therefore, conveys the findings of such an experiment carried out upon 100 students of the Faculty of Dentistry, University of Toronto, who volunteered to submit themselves for blood culture. These subjects were all young men between the ages of 20 and 26 years. An interrogation regarding

the present health and previous experience of disease was conducted and an inspection of the nose, throat, and ears of each was carried out, as well as a detailed examination of the teeth, which included X-ray examination of the full mouth. Complete physical examinations were not made, as it was felt that they would be superfluous in view of the uniformly good histories.

For the sake of uniformity in the investigation, the culture medium was all pooled before its final titration, and the blood cultures, and ear, nose, and throat inspections were all performed on the same day. The technic employed is given in detail.

The results were as follows. Of 100 cultures, 81 remained negative. The discussion must center about the remaining nineteen. Twelve of these were indisputably contaminants. The organism was, in all cases, a spore-forming bacillus. Of the remaining seven, one was evidently an air-borne contaminant. Of the six positive cultures, four were characteristic *Staphylococcus aureus*. The other two were diphtheroids.

With a view to investigating whether or not those who yielded positive cultures were constant harbo-
ters of organisms in their blood streams, new cultures were made about six weeks after the first. These second cultures all remained negative for a month.

Regarding dental examination, there were 25 cases in which the X-ray revealed apical disease in from one to four teeth. These 25 cases all gave negative cultures. None of the six with positive blood cul-
tures showed any tooth abnormality.

Regarding the ear, nose, and throat examinations, there were only 18 cases free of some evidence of inflammation. In only two were the ears involved, and they showed chronic suppurative disease of the middle ear or mastoid cells. One case with a positive culture had a muco-purulent discharge from the nose.

L J CARTER, M D

Personal Experiences with Pyelography C. F Heider *Nebraska St Med Jour*, October, 1931 XVI 385-389

This paper aims to impress on the general practitioner the importance of the pyelogram and ureterogram in the diagnosis of lesions of the upper urinary tract. During the pioneering days of pye-
lography, there were many accidents and some deaths. With the development of proper technic there is now little danger, and contra-indications to the procedure are few, acute infection and marked renal insufficiency being the main ones. The technic of retrograde pyelography and intra-venous urography are given, and slides showing a variety of lesions are reproduced as illustrations in the article.

W W WATKINS, M D

The Etiopathogenesis of Ossifications in Operative Scars E Ruggieri L'Ateneo Parmense (Suppl.), 1931, III, 84-107

The author reports a case of ossification of a scar from laparotomy, which he studied clinically and radiologically. The radiologic examination brought into evidence a niche corresponding to the pylorus on the incline of the lesser curvature, but revealed no signs of neostomy. The radiographs, taken along the anteroposterior axis, showed no manifestations referable to a hard formation of the scar.

Cases of this nature are by no means infrequent, and from the literature on the subject and from his own case the author formulates the following conclusions:

(1) Ossifications of surgical scars, like practically all other heterotopic ossifications, are manifestations of a metaplasia of the connective tissue.

(2) There is no specific etiologic agent present.

(3) The connective metaplasia is based on a defect in local circulation and on the presence, in the immediate neighborhood, of a calcareous deposit which acts simultaneously as a metaplastic stimulus and as material for induration.

(4) The predilection of post-operative ossifications for the median xiphо-umbilical abdominal tract seems due to the natural scarcity of the local blood supply.

W W WHITELock, Ph D

Roentgen Diagrams of Human Tissues and Concrements E Saupe Fortschr a d. Geb d. Röntgenstr, August, 1931, XLIV, 204-211

This is a brief review of the most important publications on the subject, showing reproductions of diagrams of several tissues and concrements.

Roentgeniography is used to investigate the molecular structure of tissues (substances in general), thus reaching beyond the limits of microscopy (spectral analysis and crystallography).

HANS A JARRE, MD

CHEMICAL ABSTRACTS

Ultra-violet Irradiation and Catalase Hans Koeppen Arch f Kinderh., 1929-1930, LXXXIX, 1-72

I The Decomposition of Hydrogen Peroxide by Blood — The author studied the liberation of O_2 from H_2O_2 by blood catalase, varying the quantities used, and measuring the O_2 set free and the rates of liberation under different conditions. He found that a definite amount of blood, with a definite catalase content, has a definite H_2O_2 -decomposing power or

energy. This energy can accomplish a definite amount of work. The time required varies with the intensity and the resistance to be overcome. The energy is exhausted in time, converted into work.

II The Decomposition of Hydrogen Peroxide by Ultra-violet Irradiation — Using a similar closed system for measuring O_2 set free from H_2O_2 , the author found that irradiation with ultra-violet light liberates O_2 . With equal intensities of irradiation, the amounts of O_2 set free are the same, for unit periods. Consequently, by standardizing the cell containing H_2O_2 , and by using a standard strong solution, it is possible to measure the intensity of radiation of the quartz lamp.

III The Decomposition of Hydrogen Peroxide by Heat — Heating of H_2O_2 liberates O_2 . Gas bubbles appear at 50°, and the maximum effect is between 60° and 70°. With the quartz lamp the highest temperatures found were from 43° to 45°. Much higher temperatures were found with other types of lamps. It is necessary to exclude the effect of heat in estimating the intensity of radiation by the H_2O_2 method.

IV The Function of Catalase — Catalase takes the O_2 from the oxyhemoglobin of the blood, and unites it to the fatty envelope of the red blood cell. In other words, oxyhemoglobin is reduced by the action of catalase, while the fatty envelope is oxidized.

V The Force Effecting the Decomposition of Hydrogen Peroxide — The author recognizes the oxidative potentialities of ultra-violet light, and thinks that catalase may be a storehouse or accumulator for radiant energy. Investigations on the catalase of blood and milk indicate that catalase belongs, in the widest sense, to the group of materials essential for life.

CHEMICAL ABSTRACTS

PHYSICAL ABSTRACTS

A New Application of the Differential Filter Method for the Production of Monochromatic Roentgen Rays Hans Kustner Ztschr f Physik, 1931, LXX, 468-491

The author has suggested a method to produce monochromatic roentgen rays by using the secondary radiation produced by roentgen rays in certain selected substances. By employing the same filter in the direct roentgen beam and then in the secondary radiation beam the difference of intensity measured gives the relatively strong characteristic radiation of the beam of the secondary radiation. The two alpha lines can be separated by placing a selectively absorbing filter into the beam of the secondary radiation. By this method monochromatic rays can be produced in the range between 25 and 0.128 Å. units. Several important applications of this method are presented.

OTTO GLASSER, Ph D

The Grating Constant of Calcite Crystals J A Bearden Phys Rev, Dec 15, 1931, XXXVIII, 2089-2098

The precise methods of measuring X-ray wave lengths, now in use, raise two important questions concerning the crystal grating used. First, what variation in the grating constant is to be expected for crystals grown under different conditions? Second, what is the most accurate value of the grating constant? Since calcite crystals are the most used crystals in X-ray spectroscopy, the present work was undertaken to answer as well as possible the above questions for this crystal. The variations in the grating constants of six calcite crystals from four sources (Iceland, Montana, Argentina, and Spain) have been determined by measuring the angle of diffraction for the molybdenum $K\alpha_1$ line in the fourth order. A high precision 2-crystal spectrometer was used for measuring the diffraction angles. The results are given in the table below. The density of these crystals was then carefully determined. From six to nine independent determinations were made at a temperature of $20.00 \pm 0.01^\circ C$. The averages of these values are given for a temperature of $20.00^\circ C$, in the fourth column of the table. The probable error determined by the method of least squares is given in the fifth column. The mass of the crystals used in determining the density is given

The Photographic Action of the Electrons Released by X-rays K Schocken and L Grebe Phot Korr, 1931, LXVII, 21-23

It is known that an intensification of the action of X-rays may be brought about by placing a thin sheet of metal over the photographic film. This is due to liberation of secondary electrons. With thin sheets of Al, Cu, and Pb, and Zeiss Ikon film from a film pack, the authors have found that the electron action increases with increasing frequency of the rays. An experiment in which a thin plate of celluloid was interposed showed that the scattered X-rays and the characteristic rays produced have only a slight action as compared with the electrons.

CHEMICAL ABSTRACTS

The Scattering of X-rays by Polyatomic Gases Y H Woo Phys Rev, Feb 15, 1932, XXXIX, 555-560

Recently, Jauncey has shown that the factor F , in Compton's formula for the scattering of X-rays by an atom, should be the average atomic structure factor F' , instead of the true atomic structure factor

| Origin | Diffraction angle θ | Difference from mean | Density g/cm ⁻³ | Probable error | Mass of crystals g |
|-----------|----------------------------|----------------------|----------------------------|----------------|--------------------|
| Iceland | 27° 51' 34.0" | -0.4" | 2.7104 | ±0.000021 | 12.9764 |
| Iceland | 27° 51' 34.0" | -0.4" | 2.71035 | ±0.000015 | 15.5780 |
| Montana | 27° 51' 34.6" | +0.2" | 2.7102 | ±0.000081 | 7.1467 |
| Montana | 27° 51' 34.7" | +0.3" | 2.7102 | ±0.000024 | 14.8650 |
| Argentina | 27° 51' 34.7" | +0.3" | 2.7102 | ±0.000042 | 11.0769 |
| Spain | 27° 51' 34.4" | 0.0" | 2.7102 | ±0.000036 | 13.0083 |
| Mean | 27° 51' 34.4" | | 2.71026 | | |

In the sixth column Considering the density measurements of DeFoc and Compton, the writer gives the density ρ in g/cm⁻³ at $20^\circ C$ as $\rho = 2.71030 \pm 0.00003$. The crystals were then chemically analyzed. The results showed that all samples contained about 0.01 per cent ferrous oxide, 0.01 per cent manganese oxide, and 99.98 per cent calcium carbonate. The angle between the cleavage faces of the calcite crystals was determined by three methods. X-rays were used for determining the angle in the first two methods and an optical method for the third. The results for $20^\circ C$ were $\alpha = 105^\circ 3' 29''$ or $\beta = 101^\circ 54' 4''$, where α is the interior obtuse dihedral angle, and β the angle between the edges of the crystal. The grating constant of the crystal can be calculated from the equation $d = (\pi M / \rho N\phi)^{1/2} = 3.02816 \text{ \AA}$ at $20^\circ C$, $= 3.002810 \text{ \AA}$ at $18^\circ C$. The values of the constants used were, $n = 1/2$, $M = 100.078$, $\rho = 2.71030$, $N = 6.0669 \times 10^2$, $\phi = 1.09594$.

THE AUTHOR.

Taking this into account, the general expression for the intensity of total scattering of X-rays by polyatomic gases previously deduced by the writer is modified, replacing F by F' . The theory is applied to the scattering of X-rays by diatomic gases and the theoretic scattered intensity is actually compared with the absolute measurements made by Wollan on the scattering of Mo $K\alpha$ rays by H₂, N₂, and O₂. The values of F and F' are calculated from the Hartree field. On the whole, Wollan's results support the new formula, though the old one represents in each case the general feature of the scattering curve. It is pointed out that, for the scattering by a diatomic gas of like atoms, Jauncey's theory of the scattering of X-rays by polyatomic molecules consisting of atoms of one kind gives results practically identical with those of the present theory, provided the change of wave length due to the Compton effect is corrected for.

THE AUTHOR.

The Absolute Determination of the r-unit in the Range of Radium Rays Erich Albrecht Strahlen-therapie, Oct. 3, 1931, XLII, 328-336

The author discusses first the general principles of a large barrel ionization chamber and its possible use for the measurement of gamma-rays in r. Wall material is only equivalent to air for this purpose, if the same number of photo and Compton electrons are produced and if these electrons are absorbed exactly as in air. Measurements in the gamma-ray region with the large chamber are dependent upon its diameter and also upon its length. As far as the wall material is concerned, it must have a very definite thickness which has to be determined experimentally for each material. This is of great importance in the standardization with radium according to Solomon's method. Comparative measurements by means of chambers with improper wall thickness will lead to erroneous results. Small ionization chambers can be calibrated against large barrel chambers of proper construction and the isodoses for radium preparations then determined in r.

ERNST A. POHLE, M.D., Ph.D.

The Demonstration and the Intensity of the Mitogenetic Radiation—I H. Schreiber and W. Friedrich Biochem Ztschr., 1930, CCXXVII, 386-400

In an attempt to find a physical detector for the mitogenetic radiation, the authors studied the effect from cultures of *Saccharomyces ellipsoideus* with the photo-electric method, using the Elster and Geitel charging method and registering the string deflections of an electrometer with a photographic arrangement. In twenty-six experiments no positive effect could be detected. The authors call attention to the difficulties in interpreting the results obtained with biological detectors of mitogenetic radiation, and feel that the methods of using various ranges of the spectrum of artificial light sources to produce mitogenetic effects similar to those produced by tissue have led to erroneous conclusions. There are numerous discrepancies in the mitogenetic literature and it seems desirable to carefully go over the reports in order to possibly find and remove sources of error in the various measurements reported.

OTTO GLASSER, Ph.D.

Photo-electric Cells Vereinigte Telephon- und Telegraphenfabriks A.-G. Czeija, Nissl and Co Austrian patent 124,891, May 15, 1931

To deposit an active layer of alkali metal inside the cell, the latter is immersed in a bath of fused

alkali metal salt, and is also partly filled with the fused salt. Electrolysis is then effected so as to cause metal ions to pass from the salt inside the cell into the glass wall of the cell, and the salt in the cell is then removed, the cell replaced in the bath, and electrolysis effected in the reverse direction, so as to drive the alkali metal to the inner surface of the cell. A filament in the cell may act as electrode in the second electrolysis, and prior thereto, the cell may be evacuated and may also be coated inside with Mg by vaporization.

CHEMICAL ABSTRACTS

The Distribution of Radio-active Substances in the Air Josef Priebsch Physik Ztschr., 1931, XXXII, 622-629

An error is found in previous calculations of the distribution in the air of radio-active substances from the earth, which were made by Schmidt and apparently confirmed by the observations of E. Schmid (*Wien Sitzber.*, 1931, IIA, 27-48). The author points out that the observations of Schmid were made in the Graz basin where abnormal air conditions exist. The author also thinks Schmidt assumes too quick a decrease of radio-activity with height and makes new calculations. He obtains values between those of Schmidt and the earlier values of Schmidt and Hess.

CHEMICAL ABSTRACTS

Shadow Photography by, and the Longitudinal Scattering of, Radiant Heat I Plotnikov Phot Korr., 1931, LXVII, 6-10

In radiography by means of red or infra-red rays with any considerable thickness of material, there is often troublesome scattering, this is considered to be connected with reversible transformations in complex molecules. The periodic variation in the scattering of near ultra-violet radiation by pure water, sugar solution, etc., is also described.

CHEMICAL ABSTRACTS

A Heating Arrangement for X-ray Samples G. Wassermann Metallwirtschaft, 1931, X, 922, 923

Disadvantages of other methods are overcome by heating the sample in the stream of an inert gas which has been heated outside of the X-ray apparatus. The sample is mounted vertically in a small porcelain tube, and the gas flows from a cylinder through a furnace and then through a short movable glass tube at right angles to the sample. On the opposite side of the sample, another glass tube of larger diameter is mounted, through which the gas is removed by suction. The distance of the two

glass tubes from the sample can be closely adjusted. The thermocouple for determining the temperature of the sample is placed in the exit tube. Advantages of this method are accessibility of the sample by moving the glass tubes, adjustment of the temperature by varying the gas pressure, and accuracy of temperature measurement.

CHEMICAL ABSTRACTS

Variation in the Effective Lattice Constant of Crystals with Wave Lengths J M Cork. Phys Rev, Jan 15, 1932, XXXIX, 193-196

This investigation is carried out to determine to what extent X-ray wave lengths determined by a calcite crystal are consistent over a considerable wave length range where the refractive index is known to vary. To this end the reflection angles for particular emission wave lengths up to 5.5 Å are observed using a quartz crystal. These angles are combined with corresponding values obtained with calcite. The values for $\log(\lambda_{\text{calcite}})/2 \sin \theta$ (quartz) when plotted with wave length, assuming $(1-\mu)/\sin^2 \theta$ constant for quartz, result in a curve showing the variation due to calcite. A discontinuity exists at the wave length of the K absorption edge for calcium. The nature of the curve is in agreement with a similar one obtained by Larsen from measurements of the index of refraction. The discontinuity is in the sense to be expected from

the dispersion theories of Kallmann and Mark and Kronig. Assuming quartz as ideal in the range of from one to five Angströms, measurements with a calcite crystal are not inconsistent by as much as one-third of one-tenth of a per cent.

THE AUTHOR

Experiments on a Lenard-Cooledge Tube. Wolfgang Gentner. Ann d Physik, 1931, X, 223-243

A cathode ray tube of the Müller Company, in Hamburg, which was continually connected to the evacuating pumps, was used on the valve tube apparatus producing 210 K.V and 4 milliamperes. A broad spectrum of electron velocities was found which is due to the pulsating tension and to the velocity changes in the tube window. The determination of the practical range of cathode rays in aluminium showed a continuous change from slow to very fast cathode rays. In addition to the cathode radiation a very intense roentgen radiation was observed at the tube window. By means of a coil through which a current could be sent the intensity of the cathode-ray beam was concentrated to several times its original value while the roentgen-ray intensity was not changed by this arrangement. The effect of the cathode rays upon a number of materials was studied.

OTTO GLASSER, Ph D

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THE AUTHOR

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Otto GLASSER, Ph.D

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¹Presented by invitation, March 16, 1932, before the Bronx County Medical Society, N.Y., in a symposium on hyperthyroidism.

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Published by the International Society of Radiology.

Vol. 11

May 1936

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EDITORIAL OF THE INTERNATIONAL SOCIETY OF RADIOLOGY

Dr. HERBERT S. BEAUMER M.D., B.Sc., F.R.C.P., F.R.C.S.,
Professor of Radiology at the Harvard School of Medicine, Boston, Mass., U.S.A.

The importance of hyperthyroidism is indicated by the fact that a great medical problem such as this is worthy of entering in the discussion of its treatment. The fact that we are considering the subject from the standpoint of surgical, endocrinologic and medical treatment indicates that good results have been accomplished by each method. But perhaps it is easier than difficult to discuss.

It is any one method's, much simpler if there is to make it applicable to all cases with the development of the other methods.

1. Shall we use levothyroxine? In the United States and in the American Hospital?

2. Shall all three methods be used? - That shall be true that any one of all of the three must be used.

It is a great benefit and also a great responsibility that has been given me to write a short article from the standpoint of the physician. This branch of medicine is developing as fast as has general medicine. In the last thirty years has re the value of the medical treatment the recognition by the physician, and now, the result of this work, the following treatment is very important. But some of your writers as you will agree with me think that the thyroid gland is the best treatment for the

cases of one disease. This has great merit, as it can be seen a source of superactivity or overactivity. But this medication is really not necessary in general and it has to be in the selection of the cases. It does not help in the application of the thyroid. I recommend it to you in one situation and at the proper time if it is true that it does help.

In writing this hyperthyroidism, we must assume that the patient has an excess of secretion from the thyroid gland either because of an enlarged gland or the stimulation of the thyroid because of an overactivity of the thyroid or an overactive tissue. The physician aims to reduce the activity of the gland and therefore thus reducing the sensitivity of the gland. The doctor reduces the activity by cutting a part of the thyroid, saying it by removing part of it, if the gland and the surrounding cells to reduce the sensitivity of the gland and to decreasing the activity of the surrounding cells. When a patient is under treatment a reduction the sensitivity of the cells is first reduced as is shown in the figure illustrating that the sensitivity of the thyroid is lowered more rapidly than the gland.

In 1922, I had found the function of the thyroid glands to be normal, the diameter of 17 mm. of the thyroid gland is 5% to 15% of the normal value for the same

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In dealing with hyperthyroidism, we must assume that the patient has an excess of secretion from the thyroid gland, either because of an over-production of the glandular tissue, or because of an over-activity of the normal amount of glandular tissue. The internist aims to reduce the activity by rest and medication, thus reducing the irritability of the gland. The surgeon reduces the activity by cutting off part of the blood supply, or by removing part, or all, of the gland. And the radiologist aims to reduce the secretion both by the reduction of the hypertrophy and by decreasing the activity of the secreting cells. When a patient is under irradiation treatment, the hyperactivity of the cells is first reduced, as is shown by the clinical observation that the symptoms of thyrotoxicosis disappear more rapidly than the goiter.

In 1923, Weil found that, because of the enormous richness in capillaries, the circulation for 100 gm of the thyroid gland is 500 c.c. of blood per minute, while for the same

¹Presented by invitation March 16, 1932 before the Bronx County Medical Society, N.Y., in a symposium on hyperthyroidism.

quantity of kidney it is only 100 c.c., and for the inactive musculature only 12 c.c. per minute. This gives the reason for the enormous amount of toxin which can escape into the blood in a short time.

By transplanting particles of the thymus gland of patients suffering from Basedow's disease, Bircher, also in 1923, was able to produce typical Basedow's disease in dogs. This indicates that not only the thyroid, but also the thymus, is involved in Basedow's disease, explaining why it is necessary for us to include this gland area in our treatment.

It has been found that over-active glandular tissue is more sensitive to irradiation than normal. The fact that normal glandular tissue is not easily affected by the rays explains, in part, why we very rarely observe hypothyroidism after our treatment. For example, Ivy, Orndoff, and others found that it took about six human erythema doses to depress the functions of the submaxillary gland in the dog. This is about twice the amount of the total irradiation given for hyperthyroidism in from six to eight months, instead of one dose as was given to the dogs. We have proof also of the resistance of the normal thyroid tissue in the fact that the enormous amount of irradiation given in the treatment of carcinoma of the larynx is not followed by hypothyroidism.

Walter, Anson, and Ivy² state that the experimental literature at hand indicates that normal thyroid tissue is resistant to X-rays, and conclude from their own studies that "the normal thyroid of the dog is quite resistant to X-rays and degenerative changes are not caused by the dosage used in the experiments, which is a dose known to be of some clinical value," and "in the dosage used do not cause extensive proliferation of connective tissue. The results indicate that the clinical dosage in the

treatment of hyperthyroidism will not injure the parathyroids" None of our patients treated by irradiation has shown any tetany.

It would seem logical that the internist's services would be most valuable, no matter whether a patient is treated by surgery or irradiation. Therefore, when the internist has removed the causes and physiologic rest is not sufficient, then either surgery or irradiation, and sometimes both, must be used.

When surgery seems advisable, one must overcome the objection to operation, the patient must be hospitalized, there are added the shock and risks of an operation, and the surgeon must guess as to how much glandular tissue he shall remove. The more expert surgeon, who has the greatest skill and the keenest judgment, will obtain the best results, for he will know best how much to excise and will do it with the least risk and shock.

When irradiation is decided upon, there is no pain, no discomfort, no shock. With modern skill there should be no risk, and certainly no deaths, due to the treatment. Only rarely need the patient be hospitalized. In many of our milder cases, the patient has continued with his, or her, occupation, and yet good results have been obtained.

Surgery has the advantage of producing more prompt results, but this difference is not so great as would at first appear. With irradiation, we usually see some improvement at the end of a month, and very definite improvement at the end of two months. If the surgeon prepares the patient for two weeks before operation, allows him two weeks to recover from the operation, and a month for convalescence, the difference in time is not so great. At the end of these two months, however, we may generally expect a more complete relief of symptoms from surgery than from irradiation, because the surgeon removes the excess of glandular tissue at once, while with irradiation we reduce the hyperactivity and the hypertrophy,

or hyperplasia, gradually. This is a slow and progressive effect.

If the surgeon has sufficient experience, skill, and judgment to remove just the right amount of glandular tissue, then the patient will be entirely relieved of symptoms. But if he removes too little, there will be only an amelioration, and, if he removes too much, hypothyroidism will develop. In other words, the surgeon has one guess, and the radiologist has from five to eight guesses.

For this reason, it is my custom to give one series in which a 40 per cent erythema dose is given over each of four fields, and then to repeat in three weeks, then in four weeks, after which the interval is governed by the amount of relief of symptoms. It is our aim to produce results, but, generally, we require from five to eight series. If, after three or four such series, there is no definite improvement which justifies us in assuming that the patient will get well, an operation should be urged upon the patient. Very few cases have had to submit to operation.

This naturally raises the question of increased difficulty in operation, when necessary, because of the previous irradiation. There is no theoretic or practical reason for increased difficulty after such an amount of irradiation as indicated above, which involves less than a total of 150 per cent of an erythema dose distributed over a period of three months. When the treatment is carried to the extent of producing a fibrosis, then operation will be made more difficult. It requires more than eight series such as I have described above to produce fibrosis, atrophy, or telangiectasis. In the past, when it was difficult to measure the exact amount of irradiation, or when radiologists failed to take account of the total radiation value, such fibrotic changes were produced. *It is the total amount of irradiation that brings about degenerative changes, whether given in one large dose or many small doses.*

It is the general opinion of radiologists that preliminary irradiation is justified in all cases of hyperthyroidism in which the goiter, if present, is not causing sufficient mechanical pressure or in which the symptoms are not so acute as to make delays dangerous. It has been argued that the delay of two or three months before an operation, if necessary, will lead to damage of the heart. One must realize, however, that it usually takes some time until an operation is decided upon or until the patient will consent. This time can certainly be utilized to advantage by preliminary irradiation. If there is a prompt response, then an operation can be avoided. Holzknecht³ stated that not one case is found in the literature proving that prolongation of the irradiation resulted in unnecessary damage to the heart.

The operations certainly must be confined to those cases in which there is a goiter, whether this be hyperplasia or an adenoma. There are, however, a group of cases of hyperthyroidism in which there is no enlargement of the thyroid, and no palpable tumor. These cases respond to irradiation in the same manner as the goiter cases, furnishing the best proof of hyperactivity of the cells. They also evidence very definitely that irradiation restores such hyperactivity to normal.

In our experience, the toxic adenomas, while they may not entirely disappear, respond to irradiation in the same way as the hyperplastic variety of goiter with hyperthyroidism. Generally, there is at least a reduction. It has been claimed that all adenomas should be removed, because of the danger of later malignant degeneration. Since, however, carcinoma of the thyroid seems to be especially sensitive to irradiation, we may in fact be preventing or curing such early degeneration. In this connection I have been corresponding with Dr. Holmes, Dr. Loucks, Dr. Soiland, Dr. Christie, Dr. Ginsburg, Dr. Orndoff, Dr.

³Guido Holzknecht, Strahlentherapie, 1928, XXX, 605-612

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²O. M. Walter, B. J. Anson and A. C. Ivy, *Radiology*, January, 1931, XVI, 52-58.

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Stevens, and Dr Portmann Their observations, together with my own, cover over 1,200 cases of toxic adenoma, and none of us has seen a case in which there was found malignant degeneration after irradiation It is likely that, in this number of cases, there were a few in which, if they had been operated upon and examined microscopically, some early malignant degeneration would have been found

Dr A C Ivy, of Chicago, who is doing some excellent research work, writes

We had a young dog with an adenoma of the thyroid on which we did a biopsy and then gave an X-ray series The adenoma disappeared slowly We observed the animal for two years, at the end of which time he was killed No evidence of malignant degeneration was found We wanted to do a large series (10 or 20) of dogs, but did not have funds available That kind of work is quite expensive and dogs are the only animals that quite commonly manifest adenoma of the thyroid spontaneously

Bensley has shown that a high protein diet fed to opossums, when confined to cages, will induce a marked hyperplasia of the thyroid Ivy and his associates have shown that roentgen treatment will prevent this hyperplasia to a considerable extent

Technic—In general, I depend upon the roentgen rays, using the so-called low voltage technic 130 KV, 5 ma, 8 mm at 30 cm distance, filtered through a combination filter of copper and aluminum equal to 6 mm of aluminum With my equipment, this gives 40 per cent of an erythema dose We use two anterior and two posterior fields, each about 5 X 15 cm, to include both the thyroid and the thymus and to expose all parts of the glands equally The larynx and the remainder of the body are protected This series of four doses is given in succession in one day, being repeated in three weeks then in four weeks, increasing the interval according to the improvement

obtained We always aim to give as little as possible, stopping when the basal metabolism falls to +15 or +10

I have not observed an increase of symptoms following the first irradiation Such effects have, however, been observed by others (Pordes, Goette)

We have treated with radium only a few cases which were unsuitable for roentgen therapy Loucks and Ginsburg prefer radium, and have obtained excellent results Surely equally good results can be obtained with radium as compared with X-rays It would seem that radium is preferable for patients who cannot come for treatment, or for whom the excitement caused by the machinery would be harmful In one very acute case in which we applied radium, there was no interruption of the symptoms the patient dying within a few days It was the opinion of all that the patient would have died in the same time if no such treatment had been given

To allay the nervous symptoms, we have been using quinine hydrobromide as recommended by Bram in 5 gr doses, given three times a day during at least the first three weeks It is remarkable, as Bram reports, that these patients can take even larger doses without the symptoms of cinchonism, which would occur in a normal individual We have not found the use of iodine helpful, except in a few cases of exophthalmic goiter in which it was used for a short time It seems to be the general opinion of radiologists that iodine should not be used in conjunction with irradiation Holmes, however, found it useful for a short time Surgeons find iodine useful to prepare for operation, but they do not advise its continuous use

Rest is always helpful and should be carried out so far as is practical In many of our cases the patients have had to continue with their occupations I always advise, however, to get as much rest in bed as is possible, to avoid all unnecessary physical

or mental exertion or excitement, to avoid all stimulants, including tea and coffee, never to stand when they can sit, and never to sit when it is possible to lie down, even for a few minutes. These rules are especially important during the first month.

Results of Treatment.—After all, the final results are what count. Unfortunately, there are at present no large irradiation clinics for hyperthyroid cases, and no comprehensive statistics. But the fact that favorable statistics are gradually accumulating, even with the good results already obtained by surgery, shows that there is value in this method. In a previous paper,⁴ Dr. Vastine and I reviewed the reports of 87 authors.

Krause⁵ has collected 1,342 cases from 31 authors which were reported with sufficient detail to be of value. He found good results on an average in 82 per cent of the cases and poor results in 18 per cent. The general report is that about 65 per cent become symptom-free and remain well, approximately from 15 to 20 per cent more are improved and return to their occupations, and from 10 to 20 per cent do not improve.

The record of my private cases treated for hyperthyroidism have been reviewed for me by my associate, Dr. Jacob H. Vastine. The hospital cases have been more difficult to follow and, therefore, they are not included. The results may be stated briefly as follows:

TABLE I.—SUMMARY OF CASES TREATED

| | |
|---|-----|
| Cases with hyperthyroidism treated with roentgen rays | 361 |
| Cases treated with radium | 4 |
| Non-toxic cases treated | 50 |
| Malignancies | 26 |
| Total cases treated | 441 |
| Simple or non-toxic goiters in which we advised against irradiation, which were not treated | 153 |
| Total | 594 |

⁴G. E. Pfahler and J. H. Vastine, Am. Jour. Roentgenol. and Rad. Ther., October 1930, XXIV, 395-411.

⁵P. Krause Strahlentherapie, 1927, XXVII, 393-412.

Under *hyperthyroidism*, or *thyrotoxicosis*, we have classed all exophthalmic goiters, all toxic adenomas, and those which had a high basal metabolism associated with the characteristic nervous symptoms, even when no goiter and no exophthalmos are present.

We have *classed as cured* those cases in which the basal metabolism, taken routinely since 1921, is between +10 per cent, and —10 per cent, the pulse has returned to normal, the weight has increased, approximately, to what it was before the onset of toxic symptoms, and nervous and other clinical manifestations have subsided, and in which the goiter has either completely disappeared or is so involuted as to be entirely unobjectionable from a cosmetic standpoint.

We have *classed as improved* those cases in which the basal metabolism is within normal limits or is markedly decreased, in which all clinical signs of thyrotoxicosis have disappeared, except a residual myocardial deficiency, which was present before the beginning of irradiation, or inoperable cases given irradiation to reduce the toxicity and to prepare them for operation.

We have divided all cases into "mild," "moderate," and "severe." The summary of results is shown in Table II (see next page).

Discussion.—Table II shows

1. The percentages of cures in the "mild" and "severe" cases are practically the same, 52.7 per cent and 52.3 per cent, and those which are "improved" approximately 31 per cent, or 83.5 per cent which have been cured or greatly benefited.

2. The "moderate" cases show 63.8 per cent of cures, 25.4 per cent improved, and only 10.8 per cent which were not benefited.

3. Taking all groups, approximately 57 per cent are cured, 31 per cent improved, and 12 per cent not improved. The total cured, or markedly benefited, is 87.8 per cent.

4 The average number of treatments (series of four fields usually given on one day) was, for the cured cases, 61, improved, 57, and the unimproved, 37.

5 The average time that these patients were under observation was, for the cured, 52 years, and for the improved 22 years.

Of the 361 cases treated for hyperthyroidism, there were 37 in which there was a hyperactive gland but *no palpable glandular enlargement*.

Of these, 22, or 64.7 per cent, were cured.

Seven, or 20.6 per cent, were markedly improved.

Five, or 14.7 per cent, were not improved.

Three could not be traced.

Of the five patients not improved, one died from hyperthyroidism after only two treatments. One died from tuberculosis, having had only one roentgen treatment. One other case had only one treatment and that without benefit. Two others had five and nine treatments, respectively, without

very marked improvement, and subsequently operations were performed. Of the 361 cases, 28 were subsequently operated upon, or 7.8 per cent. Twenty-five of the 361

TABLE III—HYPERTHYROIDISM—PERMANENCY OF RESULTS IN 293 CURED OR IMPROVED CASES

| Time since treatment | Mild cases | Moderate cases | Severe cases | Total |
|----------------------|------------|----------------|--------------|-------|
| Less than 1 year | 16 | 21 | 14 | 51 |
| 1 to 3 years | 14 | 28 | 25 | 67 |
| 3 to 5 years | 8 | 9 | 26 | 43 |
| 5 to 10 years | 10 | 32 | 39 | 81 |
| Over 10 years | 14 | 25 | 12 | 51 |
| Total | 62 | 115 | 116 | 293 |

cases were post-operative recurrences, or 7 per cent.

Of these, 10 cases, or 40 per cent, were cured.

TABLE II—HYPERTHYROIDISM—361 CASES

| | Cured | Markedly improved | Not improved | Unknown |
|--|-------|-------------------|--------------|---------|
| <i>Mild</i> | | | | |
| Number of cases | 39 | 23 | 12 | 14 |
| Percentage | 52.7 | 31.0 | 16.2 | |
| Average number of treatments | 3.9 | 3.9 | 4.7 | 1.8 |
| Average time observed, years | 4.7 | 1.5 | | |
| <i>Moderate</i> | | | | |
| Number of cases | 83 | 33 | 14 | 8 |
| Percentage | 63.8 | 25.4 | 10.8 | |
| Average number of treatments | 6.6 | 4.9 | 4.1 | 2 |
| Average time observed, years | 5.7 | 1.5 | | |
| <i>Severe</i> | | | | |
| Number of cases | 68 | 47 | 15 | 5 |
| Percentage | 52.3 | 36.2 | 11.5 | |
| Average number of treatments | 6.9 | 7.3 | 2.6 | 1.4 |
| Average time observed, years | 5.1 | 3 | | |
| <i>Total</i> | | | | |
| Number of cases | 190 | 103 | 41 | 27 |
| Percentage | 56.9 | 30.9 | 12.2 | |
| Average number of treatments | 6.1 | 5.7 | 3.7 | 1.7 |
| Average time observed, years | 5.2 | 2.2 | | |
| Total cured or markedly improved—87.8 per cent | | | | |

Ten cases, or 40 per cent, were markedly improved

Five cases, or 20 per cent, were not improved

Eighty per cent were cured or markedly improved

In 19 patients, 25 pregnancies were carried to successful termination without recurrence of the previous goiter or toxic symptoms

Sixteen patients of whom we have a record developed definite telangiectasis, 36 per cent of the 441 cases treated

Metabolic rate below 10 following treatment was produced in only four, or 9 per cent, of 441 cases treated. *In only one of these is thyroid extract necessary to relieve symptoms.*

In three cases which were not responding satisfactorily, we tried treatment over the cervical sympathetic ganglia and over the suprarenals, but with no appreciable effects. Hoarseness did not develop, because the larynx and arytenoids were protected. Two cases developed a severe trachitis, but these two had more than the eight series, and the effects may not have been due to the irradiation.

SUMMARY AND CONCLUSIONS

A review of the literature shows a progressively increasing recognition of the value of both roentgen rays and radium in the treatment of thyrotoxicosis. The results obtained by irradiation are equal to those obtained by surgery, with less shock or risk to the patient. The basal metabolism can be gradually reduced to normal, and there is practically no danger of produc-

ing hypothyroidism. None of my cases has developed tetany. We can assume that no harm has been done to the normal parathyroid.

A review of 361 cases treated for thyrotoxicosis shows cure or marked improvement in 87.8 per cent. It would seem that we must answer our queries as follows:

1. Not surgery, nor irradiation, nor medication can be depended upon to cure all cases and no one is so much superior that we can recommend it to the exclusion of the other two. Our records show almost exactly as many cases referred by us to the surgeon as were referred to us after surgery had failed. Usually the patients do not reach either the surgeon or the radiologist until the internist has failed to obtain satisfactory results.

2. No definite rules can be laid down at present for the selection of the method for the individual patient. It is the general opinion of radiologists that all cases which are not seriously involved by mechanical pressure, or so acute as to make delay of a month dangerous, should be treated by irradiation.

3. Irradiation and every valuable method of medication can certainly be combined to advantage. If there is no definite improvement after two or three months, surgery can still be used. The delay which always precedes operation can be used to advantage in this manner.

4. When irradiation fails, surgery can still be used; when surgery fails, irradiation can be used. Medication and the advice of the internist are of value in all cases, but there will remain a small number in which we all will fail.

4 The average number of treatments (series of four fields usually given on one day) was, for the cured cases, 6.1, improved, 5.7, and the unimproved, 3.7.

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3. Irradiation and every valuable method of medication can certainly be combined to advantage. If there is no definite improvement after two or three months, surgery can still be used. The delay which always precedes operation can be used to advantage in this manner.

4. When irradiation fails, surgery can still be used; when surgery fails, irradiation can be used. Medication and the advice of the internist are of value in all cases, but there will remain a small number in which we all will fail.

4 The average number of treatments (series of four fields usually given on one day) was, for the cured cases, 6.1, improved, 5.7, and the unimproved, 3.7

5 The average time that these patients were under observation was, for the cured, 5.2 years, and for the improved 2.2 years

Of the 361 cases treated for hyperthyroidism, there were 37 in which there was a hyperactive gland but *no palpable glandular enlargement*

Of these, 22, or 64.7 per cent, were cured

Seven, or 20.6 per cent, were markedly improved

Five, or 14.7 per cent, were not improved

Three could not be traced

Of the five patients not improved, one died from hyperthyroidism after only two treatments. One died from tuberculosis, having had only one roentgen treatment. One other case had only one treatment and that without benefit. Two others had five and nine treatments, respectively, without

very marked improvement, and subsequently operations were performed. Of the 361 cases, 28 were subsequently operated upon, or 7.8 per cent. Twenty-five of the 361

TABLE III—HYPERTHYROIDISM—PERMANENCY OF RESULTS IN 293 CURED OR IMPROVED CASES

| Time since treatment | Mild cases | Moderate cases | Severe cases | Total |
|----------------------|------------|----------------|--------------|-------|
| Less than 1 year | 16 | 21 | 14 | 51 |
| 1 to 3 years | 14 | 28 | 25 | 67 |
| 3 to 5 years | 8 | 9 | 26 | 43 |
| 5 to 10 years | 10 | 32 | 39 | 81 |
| Over 10 years | 14 | 25 | 12 | 51 |
| Total | 62 | 115 | 116 | 293 |

cases were post-operative recurrences, or 7 per cent

Of these, 10 cases, or 40 per cent, were cured

TABLE II—HYPERTHYROIDISM—361 CASES

| | Cured | Markedly improved | Not improved | Unknown |
|--|-------|-------------------|--------------|---------|
| Mild | | | | |
| Number of cases | 39 | 23 | 12 | 14 |
| Percentage | 52.7 | 31.0 | 16.2 | |
| Average number of treatments | 3.9 | 3.9 | 4.7 | 1.8 |
| Average time observed, years | 4.7 | 1.5 | | |
| Moderate | | | | |
| Number of cases | 83 | 33 | 14 | 8 |
| Percentage | 63.8 | 25.4 | 10.8 | |
| Average number of treatments | 6.6 | 4.9 | 4.1 | 2 |
| Average time observed, years | 5.7 | 1.5 | | |
| Severe | | | | |
| Number of cases | 68 | 47 | 15 | 5 |
| Percentage | 52.3 | 36.2 | 11.5 | |
| Average number of treatments | 6.9 | 7.3 | 2.6 | 1.4 |
| Average time observed, years | 5.1 | 3 | | |
| Total | | | | |
| Number of cases | 190 | 103 | 41 | 27 |
| Percentage | 56.9 | 30.9 | 12.2 | |
| Average number of treatments | 6.1 | 5.7 | 3.7 | 1.7 |
| Average time observed, years | 5.2 | 2.2 | | |
| Total cured or markedly improved—87.8 per cent | | | | |

Esophagus—A diverticulum of the upper end of the esophagus, observed in the postero-anterior and lateral directions in Figures 70 and 71, exemplifies the manner in which barium may protrude beyond the normal contour of the esophagus. This illustration also shows the manner in which the neck of the diverticulum joins the esophagus.

An extremely small area of malignant induration of the mucosa, which involves only part of the circumference of the esophagus (Fig. 72), protrudes into the lumen and displaces the barium, thus giving an alteration from the normal contour. This illustrates the first fundamental finding which enables one to detect small pathologic lesions.

Stomach—The contour of the lumen of the normal stomach viewed in profile in various directions has been illustrated in Figure 5. Alterations in the lumen caused by pathologic lesions of the mucosa are evidenced, firstly, by growths of the mucosa or other structures which protrude into the lumen of the stomach, and, secondly, by a break in the mucosa as by an ulcer which allows the "fluid cast" to protrude beyond the normal contour. A case of the first kind is illustrated in Figure 73, where a growth is observed to protrude from the greater curvature of the antrum into its lumen. The surface of the central portion of this growth has been destroyed, resulting in an ulcer. The surgical specimen of this case illustrates the manner in which ulcerating malignancies protrude into the lumen of the stomach (Fig. 75). The diagnosis of neoplasms of this type may be based on a single roentgenogram or, at most, on two or three roentgenograms for the reason that gastric peristalsis, as observed by serial roentgenography, is not essential to the diagnosis.

A break in the mucosa, as by an ulcer, allows the fluid cast to protrude beyond the normal contour and therefore appears as a crater or niche. Such a break is shown in Figure 74. This ulcer was removed by surgery prior to the time that we began our study of the pathology of ulcer, so that a section of that specimen is not available for photographic illustration. However, a photograph of a longitudinal section of a similar ulcer is shown in Figure 76.

Cap—The term "cap" was first applied to two or three cm of the gastrointestinal tract just distal to the pyloric valve in an article published in "Archives of the Roentgen Ray," April, 1912. This area was then described as one of the most important regions in the entire gastro-intestinal tract. The text as it was originally written, more than twenty years ago, so accurately describes the findings as we have now observed them that we are quoting *verbatim* from this original article, and we have had a special page of illustrations (Fig. 77) struck off from the original half-tone plate that illustrated the article and which, fortunately, we still possess.¹ The numbers which the reader will find in the quoted portions of the 1912 article refer to the small figures shown in the sheet of illustrations just mentioned.

The peristaltic waves of the small intestine are so rapid and small that it is

¹The reader will find Figure 77 following Figures 88 and 89, out of its numerical order, this arrangement which makes for better binding was decided on after the figure numbers had been allotted.

PART III

FINDINGS OBSERVED IN THE GASTRO-INTESTINAL TRACT

By THE COLE COLLABORATORS

BY observing barium within the lumen of the gut in roentgenograms of full size, with or without the grid, and in small roentgenograms, with or without the grid and with or without pressure, *findings* are obtained which enable us to determine definite characteristics of the mucosa in various regions of the tract

Four fundamental findings form the criteria for exploring the mucosa of the gastro-intestinal tract

- (1) The lumen of the tract viewed in profile
- (2) Special folds of the mucosa viewed on edge
- (3) Pliability of the mucosa to peristaltic contraction
- (4) The pattern of the mucosal folds or rugae

All of these are well known. Some are so familiar as to be regarded with contemptuous indifference. Still others, with slight modifications, are now the vogue.

The object of this communication is to evaluate these four fundamental findings, regardless of the popularity of prevailing fashions. In this evaluation the gastro-intestinal tract will be considered under five distinct regional headings (1) esophagus, (2) stomach, (3) cap, (4) small intestine, and (5) colon. Each of the four fundamental findings may be observed in each of the five regions.

FIRST FUNDAMENTAL FINDING

(The Lumen of the Tract Viewed in Profile)

The contour of the surface of the mucosa as it appears in the silhouette of the lumen of a hollow viscous when moderately filled with an opaque meal or air, constitutes the first fundamental finding. The esophagus distended in this manner and viewed from different angles (Fig. 20) serves to illustrate this finding. Such a procedure may be likened to one walking around a tree examining its bark and noticing whether it is smooth or rough, bulged as by a growth, or barked as by an ulcer (Fig. 66). Alterations in contour due to physiologic changes are variable and not constant. Any organic lesion which projects into the lumen of the gut diminishes the space occupied by the barium and causes what is known as a "filling defect." Any break in the mucosa, or any abnormal pouching of it, allows the barium mixture to protrude beyond the normal contour of the organ. This protrusion is defined as a crater, niche, or diverticulum. This first finding is applicable in all five regions of the gastro-intestinal tract and will be described and illustrated in each region.

Esophagus—A diverticulum of the upper end of the esophagus, observed in the postero-anterior and lateral directions in Figures 70 and 71, exemplifies the manner in which barium may protrude beyond the normal contour of the esophagus. This illustration also shows the manner in which the neck of the diverticulum joins the esophagus.

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by the Reds Dr Tower drew my attention to the fact that the idea of the toga was obtained from the "pilleus." Therefore, in a subsequent article, we discussed the cap under the title, "Physiology of the Pylorus, Pilleus Ventriculi and Duodenum as Observed Roentgenographically."

This cap varies in size, shape, and position, but a normal cap can usually be differentiated from a pathological one. It varies in different patients. Figures 4, 5, and 6 represent different types of the cap. It varies with the posture, but without pressure on the abdomen, as described in the first article, there is no tension on the first portion of the duodenum, the cap is symmetrical, its lines are clear-cut and well defined, as shown in Figure 7. But with the same patient in the erect posture the distended stomach drags on the cap, and there is usually an attenuated appearance of the cap, as shown in Figure 8. Frequently, in cases in which the cap is not completely filled, the level of the chyme is discernible (Fig 9). Occasionally above the chyme an accumulation of gas may be seen, similar to that usually seen in the stomach (Magenblasse). The cap varies during each gastric cycle. Sometimes it sets up on the head of the pylorus in a perfectly proper manner (Fig 10), separated from it by about 3/16 of an inch, at other times it drops down over the head of the pylorus, like the lady's "peach-basket" hat (Fig 11). During the stage of diastole the stomach contents drop away from the cap and it then has the appearance of having been "blown off," as in Figure 12. The cap also varies with the activity of the intestinal peristalsis. If the peristalsis of the second and third portions of the duodenum is so active as to withdraw the food as fast as it passes through the pyloric sphincter (valve), the duodenal cap may not be dilated to its full size.

There may be an angulation of the cap at the pyloric sphincter (valve). The cap may be displaced to the left, or, what is more likely, the pyloric end of the stomach is drawn to the right, while the cap is held in its normal position by the gastrohepatic ligaments. This condition is illustrated in Figure 13. In Figure 14 there is an irregularity on the greater curvature near the pylorus, which may indicate the attachment of adhesions to the pyloric end of the stomach, drawing it to the right.

In other cases the angulation may be due to adhesions binding the pyloric end of the stomach to the lower surface of the liver. This does not allow space for the cap to surmount the head of the pylorus, and it is displaced backward and to the right, as illustrated in Figure 15.

In all of those cases there was more or less evidence of obstruction, but in none of these, except possibly in the last, was there any evidence of adhesions contracting the lumen either of the pylorus or duodenum.

The clear space between the cap, just described, and the bismuth contents of the pyloric end of the stomach during the systole indicate accurately the pyloric sphincter [now known as "valve"]. The breadth of this clear space varies slightly with the muscular development of the patient, but it is one of the most constant factors in gastro-intestinal radiography. It should be 3/16 inch, varying from $\frac{1}{8}$ to $\frac{1}{4}$ inch, both outlines should be clear-cut and well-defined during the gastric systole, as illustrated in Figures 16, 17, and 18. The lumen of the pyloric sphincter should be in the center of the sphincter, and about $\frac{1}{8}$ inch in diameter. The variation of the radiographic appearance of the pyloric sphincter during different phases of the gastric cycle is due in part

difficult to study them either fluoroscopically or radiographically. We can, however, radiographically distinguish the ileum by the coagulated appearance of the bismuth contents, and the jejunum by the flocculent appearance (Fig 1). This appearance is constant in normal cases, but may be modified in pathological conditions and in cases of intestinal motor inefficiency.

The second and third portions of the duodenum are usually readily identified by their shape and position (Figs 2 and 3), unless the intestinal peristalsis is so active as to have a tendency to suck the food away from the pyloric sphincter (valve) more readily than it is allowed to pass through. In such cases I have pursued a method of artificial dilatation of the duodenum, which will be described later on.

The first portion of the duodenum deserves special attention. Anatomically and physiologically it has always been considered a part of the small intestine. Since writing this paper I have learned that Mayo has suggested, both on account of its embryology and its acidity, that the first portion of the duodenum should be considered a part of the stomach. Radiographically it should undoubtedly be considered as a part of the stomach. It is dilated into a cap which surmounts the pylorus, and corresponds in size and shape with the pyloric end of the stomach. It has absolutely no resemblance to the small intestine. Its motor phenomenon corresponds with the gastric cycle, and has no resemblance to the small, rapid, peristaltic contractions of the remaining portions of the duodenum. [The similarity of the motor phenomenon of the cap to that of the stomach has since been proven incorrect and will be described later.] The acidity of the contents of this duodenal cap may account for prevalence of ulcers, over 90 per cent occurring in this portion of the duodenum. Considering its embryology, its acid contents, its motor phenomenon, its surgical importance, and the very important part that its radiological appearance plays in the diagnosis of gastric and duodenal lesions, it should be dignified by a separate name. Its appearance and position, sitting like a cap on the pylorus, immediately suggest its name. Hence, for convenience of description, I shall call the first or ascending portion of the duodenum the "cap."

The "cap" was more popular than scientific and several of my more scientific friends urged that we adopt a scientific term for the region of the gastrointestinal tract which we believed to be so important. At that time I was working on the possible theory of the cap being an analogue of the second stomach in ruminating animals. With this theory in view I consulted with Dr. Tower, who was then curator of the New York Museum of Natural History. He was extremely interested in the subject and after spending a day or two with me we came to the conclusion that the two regions were not of similar origin. I then discussed with Dr. Tower the question of selecting a proper name for the region. Observing the size and shape of the cap as demonstrated roentgenographically, he noted its similarity to a brimless cap which was given to the Roman slaves, when they were liberated, as a token of their liberation, this cap was called "pilleus." The especial similarity attracting his attention was the manner in which the descending duodenum hung down like a tassel. The name which I had previously selected was "toga," because of the similarity of the cap worn as an insignia

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to the pressure of the food against the pyloric sphincter, as shown in Figures 19 and 20.

There is some question whether the pyloric sphincter takes part in the motor phenomenon of the stomach [as Cannon calls it, the "keeper of the gate"], contracting and relaxing during each cycle, or whether it remains contracted, the food being forced through it by the peristaltic action of the stomach. Personally, I consider the pyloric sphincter as a "butler," guarding the entrance of the intestine, and closing the door during diastole to prevent the food from passing back into the stomach. I believe that the relative strength of the pyloric sphincter (the butler) to the peristaltic contraction of the stomach (the cook) is one of the most important factors in functional derangements of the digestive tract. If the pyloric sphincter is too strong, the stomach may be over-distended with food, and yet the small intestine may be starved. On the other hand, if the pyloric sphincter is weak and the peristaltic contractions are too strong, improperly prepared food will be served to the intestine.

During the stage of systole, with the patient in the erect posture, the food is pressed up against the surface of the pyloric sphincter, and we have a clear-cut, well-defined outline of the sphincter, as is shown in Figure 21, but during the stage of diastole the food drops away from the pyloric sphincter, and there is a wide space between the bismuth contents of the cap and that of the pyloric end of the stomach, as is shown in Figure 22.

In the interpretation of the radiographic plate, great care should be taken not to interpret this space as evidence of obstruction of, or adhesions to, the pylorus.

The relation of the pylorus to the umbilicus varies with the size, position, and type of stomach. The position of the umbilicus itself also varies with the build and obesity of the patient and the flabbiness of the abdominal wall. The relation of the pylorus to the body of the stomach is much more important, and varies with the type of the stomach, as is shown in Figures 23, 24, 25. The most important point, however, is the relation of the level of the chyme to the pylorus when the patient is in the erect posture. If the upper level of the chyme is three or four inches below the pyloric sphincter (valve), and the peristalsis is inefficient, as indicated in Figure 26, how is the chyme going to get out of the pylorus even if the latter is wide open? Figure 27 is of the same patient in the prone posture, with the abdomen flat on the plate. These two plates illustrate the relative value of the two different postures in determining the shape and contour of the stomach, particularly when the stomach is dilated and atomic.

Artificial Dilatation of the Duodenum.—When the chyme is drawn away from the pyloric sphincter (valve) by unusually active intestinal peristalsis it is difficult to detect the second and third portions of the duodenum. In such cases I have adopted the following method, which was described in my article, "The X-ray Diagnosis of Pyloric and Duodenal Lesions," read before the American Association of Obstetricians and Gynecologists at Louisville, Ky., Sept. 29, 1911. A second paper, on "Artificial Dilatation of the Duodenum for Radiographic Examination," was published in the "American Quarterly of Roentgenology."

The lumen of the entire duodenum and upper portion of the jejunum can be examined by the following procedure. The patient swallows an Einhorn pyloric dilator. This is a small metallic ball and rubber bag attached to a fine rubber tube, the rubber bag collapsing round the tube just behind the ball. The whole

apparatus is as easily swallowed as the old-fashioned pill. This dilator may be administered with the food the day before, or given three or four hours before the examination, the patient assuming a position which will allow it to pass into the duodenum and jejunum.

The small rubber bag, which is surrounded by a silk bag about the size of the lumen of the duodenum, is then inflated with air, and acts as an intestinal obstruction. A meal of bismuth and buttermilk is then given by mouth, and passes readily into the duodenum, the temporary obstruction preventing the bismuth from passing on through the jejunum. The duodenum is dilated by the bismuth and buttermilk, and a radiograph shows perfectly the contour of the dilated duodenum.

I am indebted to Dr Max Einhorn for the case illustrated in Figures 28, 29, and 30. The dilator was passed into the stomach by Dr Einhorn about fourteen hours before the examination. Forty plates were made, with an interval of about five minutes between each two exposures, some before and some after the administration of the bismuth.

The first plate made after the bismuth was administered showed the stomach and cap distinctly, but the second and third portions of the duodenum were not visible. Then the second portion began to fill, as shown in Figure 28, the tube and bag being in the jejunum. Later the third portion filled, and Figure 29 shows the entire duodenum artificially dilated. In both Figures 28 and 29 the bag is not so completely inflated as it should be, but in Figure 30 one readily sees the bag properly inflated.

This case is interesting as showing how far the dilator may pass into the small intestine and yet be withdrawn without causing any unusual sensation. The dilatation of the duodenum would have been more complete if the tube had passed only into the first portion of the jejunum, and the inflation of the bag had been as thorough as in Figure 30.

The following modification of Einhorn's dilator will, I believe, be of great value. The tube is surrounded by a second tube slightly larger than the first. This outside tube terminates just behind the rubber bag, and through it the bismuth and buttermilk may be injected and aspirated directly into or from the duodenum. In this way the exact amount of the distention of the duodenum may be diagnosed.

Radiographic examination, besides showing adhesions from duodenal and gastric ulcers and gall-bladder infection, also enables us to examine the head of the pancreas, which can be more perfectly outlined by the duodenum, as suggested by Dr Crane. In some cases I have been able to clearly demonstrate the shadow of bismuth in the canal of Wirsung. [This was probably a duodenal diverticulum adjacent to the ampulla of Vater, termed by the French "perivaterans".]

This ends the quotation, and as I read the text and carefully observe the illustrations of the original article I marvel that at that time I should have had sufficient material to accurately describe all of these findings. We have already described the manner in which this small region of the tract sets up on the pyloric end of the stomach like a brimless cap, and that this term "cap" is applied because this region does resemble a cap. The term "duodenal" is often erroneously applied to it, and in the past (and by some still) this region was called the first or ascending portion of the duodenum.

However, considering that it has none of the characteristics of the small intestine the terms "duodenum" and "bulbus duodeni" are misnomers.

The appearance of the fully distended normal cap and its similarity in appearance with the pyloric end of the stomach is shown in Figure 37. The similarity in appearance of the cap and pars pylorica is strikingly shown if one covers the pyloric valve with a pencil. The outline of the distended normal cap is clean-cut and smooth. The change in outline of the base of the cap produced by contraction of the fan-shaped muscle of the pyloric canal is shown in Figures 31 and 32.

Alterations in the contour of the cap caused by pathologic lesions are largely limited to an encroachment upon the lumen of the cap. The usual exceptions are the localized dilatations of the uninvolved part of the cap proximal to an area of stenosis (Fig. 85). These are often called "pseudo-diverticula." Diverticula occur frequently in the duodenum close to the cap and are not infrequently erroneously interpreted as being of the cap proper, but true diverticula of the cap are extremely rare. We have never seen one.

Occasionally one sees in profile the crater of an ulcer which projects beyond the margin of an otherwise normal appearing cap. In these cases the inflammatory reaction around the ulcer is so slight that there is no appreciable flattening of the contour of the cap adjacent to the crater (Figs. 78 and 79).

More commonly the crater of an ulcer of the cap protrudes outside of the contour of a cap which is diminished locally in size by induration of the cap wall (Figs. 80 and 81).

Alteration in the contour of the cap by changes which encroach upon the lumen is common and familiar to all. These changes may be an enfolding of the entire thickness of the wall of the cap by a veil or band of adhesions (Fig. 82), induration around an ulcer (Fig. 83), and bands of scar tissue which radiate from the site of an ulcer (Figs. 84 and 85), or which remain as the residual change of a healed ulcer.

Small Intestine.—The variations in contour of the small intestine are principally caused by diverticula into which the barium passes, and the shadows of these diverticula protrude beyond the normal contour of the gut (Fig. 90). The lumen of the small intestine may be diminished in diameter by local bands of adhesions or tuberculous infiltration (Figs. 91 and 92), and occasionally one observes a malignant lesion or a non-malignant polyp which protrudes into the lumen.

Colon.—The contour of the colon may be altered by growths which protrude into it (Figs. 93 and 94), causing filling defects similar to those observed in the stomach and constituting the most important finding in this region, or it may be altered by pouches or diverticula (Fig. 95). Diverticulosis of the colon is a very common finding and, unless the diverticula are the seat of inflammatory reaction, they are of relatively slight clinical significance. However, when these diverticula do become inflamed the mucosa becomes the seat of an area of induration which encroaches upon the lumen of the colon, and causes a filling defect that may completely obstruct it. This is sometimes difficult to differentiate from malignancy.

SECOND FUNDAMENTAL FINDING

(Special folds of mucous situated on edge)

The second fundamental finding is the thickness and appearance of special mucous-membranous folds, such as the plica angularis and the pyloric valve, viewed on edge. The principle involved in this finding is well illustrated by a sandwich (Fig. 67), that is, two slices of bread are likened to the double layer of mucosa and the filling is similar to the submucosa. Thus, by viewing the sandwich on edge, one determines whether or not there are any lumps in the filling, or a piece nibbled out of the side as by a mouse. Thus, one may view the folds and note whether there is a malignant or non-malignant lump in the submucosa, or if the mucosa is nibbled away by a mucosal ulcer.

Sulcus angularis.—The second fundamental finding is observed in roentgenograms of the stomach as the sulcus angularis. This finding is most typically seen in roentgenograms made of the stomach during the phase of diastole of the gastric motor phenomenon and with the patient in the erect posture (Fig. 32). The sulcus is characteristically present in the sthenic and asthenic types of stomachs which have a normal tone of the muscularis propria. The sulcus is the long narrow indentation which projects from the lesser curvature into the barium column between the corpus and antrum of the stomach. During the phase of systole of the gastric motor phenomenon (Fig. 31), the sulcus varies in depth and form because at this time the sulcus corresponds to the peristaltic contracting ring in this segment of the stomach. Although, during a gastric cycle, the indentation in the barium column changes its position, this change in position is only a change in the angle of inclination to a fixed point on the lesser curvature, as the base of the sulcus progresses so slightly that it corresponds to a limited area, namely, the apex of the receding cusp which the surgeon and anatomist observe on the outside of the stomach, that is, the incisive angularis. The sulcus angularis observed in the roentgenograms is produced by the plica angularis, a long mucous-membranous fold which projects into the lumen of the stomach.

The length of the base of the contraction in the longitudinal axis of the stomach, or the thickness of the apron-like fold which projects into the lumen of the stomach, is very constant in different cases (Fig. 95, Nos. 1-6). It is about 0.5 cm. from the proximal surface at the base directly across to the distal surface of the fold at its base. Within this space of 0.5 cm. across the base of the sulcus there is insufficient room for a reduplication of all the coats of the stomach and only sufficient space for a reduplication of the mucosa and muscularis mucosae together with a core of submucosa. This indicates that the peristaltic contraction of the sulcus angularis is the function of the muscularis mucosae and not the muscularis propria. In Figure 31 we have illustrated the increase in thickness of the muscularis mucosae which occurs at the tip of the plica angularis during peristaltic contraction. This increase in thickness of the muscle layer is directly reflected in the sulcus angularis in the roentgenogram as a rounded swelling or bell-like form near the tip of the sulcus (Figs. 31, 31, and 95). The depth of the contraction of the apron-like fold itself, that is, the distance from its base to its tip,

However, considering that it has none of the characteristics of the small intestine the terms "duodenum" and "bulbus duodeni" are misnomers.

The appearance of the fully distended normal cap and its similarity in appearance with the pyloric end of the stomach is shown in Figure 37. The similarity in appearance of the cap and pars pylorica is strikingly shown if one covers the pyloric valve with a pencil. The outline of the distended normal cap is clean-cut and smooth. The change in outline of the base of the cap produced by contraction of the fan-shaped muscle of the pyloric canal is shown in Figures 31 and 32.

Alterations in the contour of the cap caused by pathologic lesions are largely limited to an encroachment upon the lumen of the cap. The usual exceptions are the localized dilatations of the uninvolved part of the cap proximal to an area of stenosis (Fig. 85). These are often called "pseudo-diverticula." Diverticula occur frequently in the duodenum close to the cap and are not infrequently erroneously interpreted as being of the cap proper, but true diverticula of the cap are extremely rare. We have never seen one.

Occasionally one sees in profile the crater of an ulcer which projects beyond the margin of an otherwise normal appearing cap. In these cases the inflammatory reaction around the ulcer is so slight that there is no appreciable flattening of the contour of the cap adjacent to the crater (Figs. 78 and 79).

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the stomach and cap. The appearance of the normal pyloric valve in relation to the normal stomach and cap is illustrated in Figure 37. The margins of the valve are smooth and clear-cut and the lumen of the valve is centric to the lumen of both the cap and the antrum.

The lesser curvature side of the pyloric valve is not an infrequent site of benign ulcers, and the ulcer may involve either the proximal or distal surface of the valve. The structure of both the distal and proximal sides of the valve is gastric in its characteristics and for this reason these ulcers should all be considered as gastric ulcers. When the ulcer involves only the mucosa and there is a very slight inflammatory reaction and induration, the roentgen evidence consists of a slight thickening of one side of the valve (almost without exception the lesser curvature side), together with the projection beyond the main barium column of the barium filling the small crater of the ulcer (Fig. 103). Around large ulcers the induration extends into the wall of both the stomach and cap, and the lesser curvature side of the valve is obliterated (Fig. 104). The induration of the wall of the stomach and cap flattens the contour of this region so that the lesser curvature side of the valve and the adjacent parts of the stomach and cap form a straight or slightly curved surface. As the greater curvature side of this region has retained its normal pliability the lumen of the valve is found to be eccentric to the lumen of both the cap and the stomach (Fig. 104). The induration around still larger ulcers may completely encircle the stomach and cap in the region of the valve (Fig. 105).

When ulcers of either the cap or the stomach lie adjacent to the pyloric valve, the induration may extend across the valve, producing a flattening of the contour and obliteration of one side of the valve (Fig. 106). The differentiation between ulcers of the valve proper and those which lie adjacent to the valve is determined by the location of the crater when this can be visualized, and otherwise by determining whether or not the valve lies at the center of the area of induration. Following healing of an ulcer a flattening of one side of the valve, with eccentricity of the lumen of the valve, may remain as a residual change (Figs. 107 and 108).

Malignant tumors of the stomach do not extend through the wall of the stomach beyond the valve to involve the wall of the cap. This phenomenon is difficult to understand but is a finding which is frequently observed roentgenographically and which often serves to differentiate between a newgrowth and an induration secondary to ulcer or inflammation. Malignant growths which extend to the valve (Fig. 109) or develop adjacent to the valve (Fig. 110) obliterate the proximal lip of the valve because this part of the valve and adjacent gastric wall is rendered non-pliable and there can be no expansion of the involved part of the stomach. If the growth involves the entire circumference of the pyloric end of the stomach, the lumen of the valve remains centric to the lumen of the cap and also to the lumen of the non-dilated antrum (Figs. 109 and 111). When the growth involves only one side of the pyloric end of the stomach the lumen of the valve remains centric to the lumen of the cap, but is eccentric to the lumen of the antrum (Fig. 135). In all malignant growths extending to the gastric side of the pyloric

varies greatly in different cases (Fig 96, Nos 1-6), and in the same case in different postures of the patient and with different degrees of gastric distension (Fig 96, Nos 7-9)

The sulcus angularis is an extremely constant roentgenologic landmark and pathologic changes in this region of the stomach are directly shown by changes in contour and volume of the sulcus. Small, superficial ulcers which involve in depth only the mucosa or the mucosa and the superficial layer of the submucosa, appear in profile as small excavations in either the proximal or distal surface of the sulcus,—a protrusion of barium into the space of the sulcus which appears as if a mouse had nibbled a small hole into one surface of the sandwich (Figs 97-100). These small ulcers are surrounded by such a small area of induration that it does not interfere with the gastric peristalsis, and as the sulcus shifts position with the progress of the peristaltic wave, the small excavation also shifts position in relation to the sulcus. At one phase the excavation may be in the proximal surface of the sulcus, and at another phase the excavation may be in the tip of the sulcus or even in the distal surface of the sulcus. When this occurs we speak of the crater of the ulcer as "riding with the wave of gastric peristalsis" (Figs 97-100).

Larger areas of induration, either malignant or non-malignant, increase the width and shorten the length of the plica angularis and produce similar changes in appearance of the sulcus angularis (Fig 101). When the induration is sufficiently large the fold, and correspondingly the sulcus, is entirely obliterated, and the absence of this characteristic finding is in itself of great significance (Fig 102), but this constitutes the third finding.

Pyloric Valve.—The lumen of the stomach is partly separated from the lumen of the cap during most of the phases of the gastric cycle by a space about 0.5 of a centimeter. This space is universally recognized by radiologists and may be termed the "pyloric valve," "pyloric sphincter," or even "pylorus." We believe that "pyloric valve" is the preferable and more accurate term. Roentgenologically, it is so definite in its character that it has become a monumental landmark for roentgenologists and they use it as a point from which to take measurements, that is, they will state that an ulcer is so many millimeters beyond the valve, or so many centimeters proximal to the valve. Although this finding is very well known to roentgenologists, it is practically unknown to anatomists and surgeons. What they term the "pyloric sphincter" is the abrupt distal end of the fan-shaped muscle that is located at or near the base of the valve. The valve itself (Fig 52), however, is composed only of a double layer of mucosa, muscularis mucosae, and a core of submucosa. It does not contain the regular circular muscular coat (muscularis propria). Therefore, the roentgenologic appearance, measurements, and character of this fold should come, strictly speaking, under the heading of this section.

When the cap and distal part of the antrum of the stomach are distended and the pyloric valve is viewed accurately in profile, the valve appears as a space between the cap and stomach about 0.5 of a centimeter wide which does not contain barium. Centrally located in this space is a small column of barium in the lumen of the valve and connecting the barium column in

scope of radiological exploration of the mucosa of the colon. Too often are these mucosal folds passed without a careful consideration of both their proximal and distal surfaces. The significance of these folds as an aid to X-ray diagnosis is appreciated when one compares an X-ray film with a specially prepared surgical specimen of the colon (Fig. 60).

The anatomists who have written and edited the standard text-books on anatomy have universally stated that the exterior of the colon shows a sacculated condition which is characteristic of the colon. "Between the sacculations are semilunar folds (*plicæ semilunaris coli*), which involve the entire thickness of the intestinal wall, forming crescentic ridges of the mucosa which project into the lumen" (*Morris*). "The exterior of the colon shows the sacculated condition, but there are no folds or *valvulae conniventes* like those of the small intestine, *valvulae conniventes* are also wanting, although there are projections into the large gut involving all or part of the coats internal to the serous tunic" (*Piersol*). The usual conception of the cause of formation of these sacculations is that the "sacculations (*haustra*) are produced by the gut having to adapt its length to three shorter bands (*tæniae coli*) which run the course of the intestine" (*Morris*).

The anatomical descriptions are quite logical as applied to the relaxed gut found at postmortem and in the anatomical cadaver used for dissection. It is impossible, however, to attempt an explanation of findings observed roentgenologically in the living subject by data obtained from such specimens. Here again, as in the stomach, surgical specimens which are preserved immediately after removal and in such a manner that their form and distension are similar to those observed in the living subject, are necessary for comparative study.

Figure 60 is a photograph (2 X magnification) of one-half of a surgical specimen prepared in such a manner, the specimen having been cut longitudinally near the lines of attachment of the mesentery and the epiploic fat pads. Projecting into the lumen of the gut are numerous folds which are directly comparable in size and distribution with the segmental rings which are observed roentgenographically and which divide the colon into the sacculations or *haustra* which are so characteristic of the colon as observed roentgenographically. The illustration shows very clearly that the folds are not a reduplication of the entire thickness of the wall of the colon, as described by anatomists, but only a reduplication of the mucosa and *muscularis mucosæ* together with a core of the submucosa similar to the *plica angularis* of the stomach. Along the superior surface of the colon, as illustrated, there is an indentation of the *muscularis propria* (both the circular and longitudinal layers of muscle), and here the indentation falls directly between two of the folds which project into the lumen and does not enter into their formation. In only one area (*A*) does the *muscularis propria* enter into the formation of a fold which projects into the lumen of the gut, and the relations in this region deserve a more detailed description in that the findings of this type may give an explanation of some of the findings observed in the roentgenograms. The fold at *A* is much broader than all of the other folds shown in this section, and the mucosal surface of the fold has three eminences. The

valve, the distal side of the valve remains normal in contour except occasionally for a slight bulging toward the lumen of the cap (Fig 111). Many extensive newgrowths of the stomach extend close to the pyloric valve but do not involve a narrow zone of the pyloric canal adjacent to the pyloric valve (Figs 112-114).

Small Intestine—The second fundamental finding is observed in the small intestine at the ileocecal valve (Fig 46), where the intestine is inserted in the side of the cecum in a manner resembling a striking cobra, the head of the cobra being pressed into the side of the cecum. The length and thickness of the leaves of the valve are significant in the problem of ileocecal incompetency, but whether or not this condition of ileocecal incompetency is of clinical significance is a most debatable question. Distortion or thickening of the ileocecal valve or a retraction of one lip of the valve may result either from adhesions associated with a diseased appendix or from pregnancy, and occasionally it is thickened by tuberculous infiltration.

The characteristic mucosal folds of the small intestine, the *valvulae conniventes* or *plicae semilunaris*, might logically be considered as special mucosal folds to be discussed under the second fundamental finding. When the small intestine is distended, they are viewed on edge in the same manner in which one views the *plica angularis*, the pyloric valve, and the segmental rings of the colon. The small sulci, which the *valvulae conniventes* form in the barium mold of the lumen of the small intestine, are, however, such an inseparable part of the mucosal pattern that we have chosen to consider them under the fourth fundamental finding.

Colon—The second fundamental finding is observed in the colon in both *Houston's valves* and in the *segmental folds or rings*. The thickness and appearance of Houston's valves, as observed with the barium enema (Fig 115), is very similar to the finding observed in the *sulcus angularis*. These valves may be obliterated or deformed by malignant infiltration or the inflammatory process associated with infected diverticula that occur in the rectosigmoid region.

The *segmental folds* (Fig 116) are so familiar that they are viewed with contemptuous indifference. Yet when one stops to analyze the fold and divide it into a base, stalk, bulb, and tip, and to study the relation of the thickness of each of these regions of the segmental fold, and to question the contents and function of the segmental folds, the motor phenomenon becomes of more than passing interest. The segmental folds in the colon are comparable with the *plica angularis* of the stomach and the *plicae circularis* in the small intestine. They increase the mucosal surface of the colon and incarcerate fecal matter between them, and, while it is collected between the segments, water is absorbed from it so that it becomes more or less solid. In many herbivorous animals—in sheep, for example—fecal matter becomes so solidified between these folds that the latter retain the typical sheep dung shape. Occasionally, similar scaly masses are observed in human beings when they do occur it is evident that they have been formed in these pockets between the segmental rings. These folds when carefully scrutinized increase the

present in folds which produce the sulci observed in the roentgenograms, it was necessary to establish the actual thickness of the various coats. Under normal conditions in the living subject the coats of the colon are much thicker than the coats as observed in the preserved specimen. The thickness as determined in specimens which have been preserved in formalin for several days may, therefore, be accepted as the minimum thickness which could be present under like degrees of distention of the gut during life. The mucosa of the colon varies from 0.25 cm to 0.5 cm in thickness. The submucosa is variable and may be minimal in amount, or in the base of a low fold or the tip of a high fold may reach 0.5 cm in thickness. The muscularis propria has a minimal thickness of 0.5 centimeter. The thickness of the coats as measured in the fresh specimen is greater than these figures, so that in constructing the colonic wall around the roentgenographic outline of the lumen of the gut we must make the thickness of the coats of the wall at the minimum the thickness of the figures given, and actually they should be made thicker in order to compensate for the contraction which takes place in the hardened specimen.

In Figure 117 we have traced the outlines and diagrammatically represented the lumen and thickness of the coats of the colon shown in Figure 60. The diagram has then been reduced to the actual size of the specimen. This diagrammatic representation of the actual specimen will, therefore, serve as a model of the actual condition present, for comparison with a theoretically constructed wall around the lumen as observed roentgenographically.

At first thought the motor phenomenon of the colon appears to be a simple process, but an analysis of the various findings observed roentgenographically and an attempt to explain these findings in terms of motor functions reveal that the contractions of the various muscle elements in the wall of the colon constitute a complicated process. The mere act of constructing the colonic wall around the lumen of the gut (as observed in the roentgenogram) reveals that there is not sufficient space within the sulci produced by the segmental rings for all of the coats of the colon to be present. Figures 118-123 are tracings of several colons, showing the type and contour of various segmental rings which we have observed. Around the contour of the lumen we have diagrammatically constructed the wall of the colon.

These diagrams show clearly that within these sulci there is only sufficient space for a reduplication of the mucosa and muscularis mucosæ, together with a core of the submucosa. Whether or not the muscularis propria may be dipped into the base of the fold by a pull through the submucosa as illustrated in Figure 60 is immaterial, since this would be only a passive change produced by forces extraneous to the muscularis propria and not an actual contraction of the muscularis propria itself.

The appearance of the wall of the gut theoretically constructed in this manner is directly comparable to the actual tracing of the wall of the colon specimen (Fig. 117). The folds are of the same type and the same composition. Figures 118-123 are tracings of segmental rings which were selected because their outlines were clearly discernible and could be traced.

center eminence is continuous with the more narrow fold which extends completely across the specimen and which is sectioned on the superior surface of the specimen. This narrow fold does not contain the muscularis propria. The indentation in the muscularis propria at *A* does not continue around the specimen but terminates a short distance from the cut edge of the specimen, as one can observe in the photograph. The two lateral eminences on the surface of this fold (*A*) also extend for only a short distance away from the cut edge of the specimen, in fact, only as far as the indentation of the muscularis propria. The findings illustrated in this photograph establish two facts. The first is that folds which include all of the coats of the colon are very considerably thicker than the folds which are only a reduplication of the mucosa and muscularis mucosae with a core of submucosa, the second is that on top of a fold due to reduplication or indentation of the muscularis propria there may be several eminences which are foldings of only the mucosa and submucosa.

There is still another finding of note which may be observed in the fold at *A*. The apex of the indented muscularis propria is thinner than the adjacent muscularis propria along the side of the fold. If this fold were due to an active contraction of the muscularis propria, one would expect exactly the opposite relation of the thickness of the muscle. For illustration of this fact refer back to the diagrammatic drawings illustrating the thickening of the muscularis mucosae in the apex of the sulcus angularis (Fig 51), and the pyloric valve (Fig 52). The muscle which is responsible for the formation of a contracting ring or fold must be thickest at the apex of the fold, as this is the maximum point of contraction of the muscle, and, therefore, the area of greatest bulk or thickness of the muscle.

While studying this illustration one should note also that the thickness of the submucosa is very variable. At *A* the mucosa is very thick under all three of the mucosal eminences. This is also the case in one of the shallow folds on the superior surface. In the deeper folds the mucosa is thin in the stalk of the fold, but definitely increased in amount in the tip of the fold. Variations in the bulk of the submucosa in relation to the folds were undoubtedly the basis of part of the formation of Forssell's theory as to the mechanism of formation of the mucosal folds in general.

In specimens of the colon which we have preserved in a similar manner, we have observed sacculations of the colon which have been separated by folds taking in the entire thickness of the wall of the gut and entirely similar to the findings described in the text-books on anatomy. This type of fold is usually observed when the colon is considerably more dilated than is the specimen illustrated in Figure 60. The muscularis propria at the apex of these folds was never thickened but ended in a point. On the outside of the gut the line of indentation was usually marked by blood vessels encircling the gut or by subperitoneal fat accumulations. It is probable that many of these folds of this type are produced by dilatation of the gut around relatively fixed lines in the external part of the wall of the gut.

In order to determine just what parts of the wall of the gut may be

present in folds which produce the sulci observed in the roentgenograms, it was necessary to establish the actual thickness of the various coats. Under normal conditions in the living subject the coats of the colon are much thicker than the coats as observed in the preserved specimen. The thickness as determined in specimens which have been preserved in formalin for several days may, therefore, be accepted as the minimum thickness which could be present under like degrees of distention of the gut during life. The mucosa of the colon varies from 0.25 cm to 0.5 cm in thickness. The submucosa is variable and may be minimal in amount, or in the base of a low fold or the tip of a high fold may reach 0.5 cm in thickness. The muscularis propria has a minimal thickness of 0.5 centimeter. The thickness of the coats as measured in the fresh specimen is greater than these figures, so that in constructing the colonic wall around the roentgenographic outline of the lumen of the gut we must make the thickness of the coats of the wall at the minimum the thickness of the figures given, and actually they should be made thicker in order to compensate for the contraction which takes place in the hardened specimen.

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without guessing at the margin of the lumen of the gut. These tracings are from roentgenograms made of the colon after administration of a barium enema. One will immediately notice that the segmental folds vary greatly in their form and depth.

- 1 Short fold (Figs 121 and 123)
- 2 Deep fold with narrow tip (Fig 120)
- 3 Fold with bulbous tip (Fig 121)
- 4 Ring with flattened tip and projection both distally and proximally (Fig 122)
- 5 Ring with projection only proximally (Fig 122)
- 6 Ring with projection only distally (Fig 121)
- 7 Ring budding off of base of deeper fold (Fig 118)
- 8 Double fold (Fig 119)

In roentgenograms made of the colon during the passage or, rather, retention of the barium meal one may observe the same type of segmented rings shown in Figures 118-123 and Figure 116-C. There is, however, a definite tendency for the segmental rings to be broadened as shown in Figure 116, A and B. Broad rings of segmental contraction of this type show the possibility but not probability of the other coats of the muscularis propria entering into the formation of the folds.

A localized increase in tone or partial contraction of the muscularis propria we believe is more likely to account for the appearance illustrated in Figure 123, a finding which is not uncommonly found in a local region when the colon is filled with a barium enema. A similar finding is present in the middle of the transverse colon in Figure 116-C.

The effect upon the segmental rings of the extensive waves of contraction (the waves which Case has described) which move forward a large amount of the contents of the colon gives us a great deal of information regarding the nature of the segmental rings. These extensive waves of contraction begin in the ascending colon or in the region of the hepatic flexure. The contraction may extend for variable distances, to the middle of the transverse colon or into the descending colon. From the evidence which we have assembled, the relaxation of the contracted gut is in the reverse direction from which the contraction occurred. For a long time we have desired to study this phenomenon by roentgenocinematography, but as yet have not gotten to it. These waves of contraction are infrequent in occurrence and cannot be accurately anticipated. However, during the making of serial roentgenograms of the colon we have recorded the appearance of the colon in local regions before, during, and after this phenomenon has occurred, and from these records we have obtained much valuable information and are able to state that the following changes may occur in the colon:

- 1 When an extensive contraction of the muscularis propria occurs the segmental rings are not completely obliterated. As soon as the most intense force of the contraction is spent, the segmental rings can be recognized as flattened segments which give a grossly serrated appearance to the margin of the contracted gut (Fig 124 and Fig 116-D). Before we recognized

that these segmental folds remained as definite formations when the colon was contracted by the muscularis propria, we had been greatly puzzled by this gross serration of the lumen of the contracted gut. It is a familiar finding in practically all roentgenograms made of the colon after evacuation of a barium enema.

This phenomenon is shown characteristically in Figure 126, which is a tracing of two roentgenograms from a series of roentgenograms made of the proximal part of the colon while filled with a barium enema. The patient is lying prone in the right oblique position so that there is no confusion or overlapping of the shadows of the colon from the hepatic flexure to near the middle of the transverse colon. The solid line is a tracing of the outline of the colon as shown in Film No 5 of the series. At this time the colon was moderately distended and the segmental rings which divide the first part of the transverse colon into sacculations or haustra are shown distinctly in profile. The outline of the colon is not distorted by longitudinal trisection of the colon by the longitudinal bands.

The interrupted line is a tracing of the outline of the colon as shown in Film No 9 of the series. The outline only of the colon is shown, the intrinsic mucosal markings or pattern not being included. At this time there was an extensive contraction which extended from the cecocolic tract to past the middle of the transverse colon. The shortening of the colon which takes place when this type of contraction occurs is shown distinctly in the shortening of the ascending colon, with depression of the hepatic flexure and deviation of the cecum, and, also, in a shortening of the transverse colon which brings into view segmental folds not seen in Film No 5, and pulls the hepatic flexure anteriorly. For identification we have numbered the segmental folds on both the inferior and superior surfaces of the transverse colon. Superimposition of the two tracings shows that every segmental fold observed in Film No 5 may be identified as a flattened-out, broader fold in Film No 9. The relation of the folds to each other is the same when the colon is partially distended and when it is contracted. This finding shows that the muscle element producing the segmental folds is not the same muscle that produces the more general contraction and the mass movements of the colon.

2. The independence of the segmental folds from contraction of the muscularis propria is further shown by the fact that a long segment of the colon may temporarily contract without disturbing the arrangement of the segmental folds. Figure 127 is a tracing of three roentgenograms from a series of five which were made of the transverse colon while the colon was filled with a barium enema. This series of films was made with an interval of a minute following each roentgenogram and the experiment was made with the definite object of determining what changes occurred in the segmental folds during a short interval of time. We were fortunate in accidentally recording on Film No 2 a mass contraction which occurred and relaxed during the interval of three minutes between the making of Films No 1 and No 4. Film No 2 was probably made at the height of contraction and at this time the proximal part of the colon was contracted and the

without guessing at the margin of the lumen of the gut. These tracings are from roentgenograms made of the colon after administration of a barium enema. One will immediately notice that the segmental folds vary greatly in their form and depth.

- 1 Short fold (Figs 121 and 123)
- 2 Deep fold with narrow tip (Fig 120)
- 3 Fold with bulbous tip (Fig 121)
- 4 Ring with flattened tip and projection both distally and proximally (Fig 122)
- 5 Ring with projection only proximally (Fig 122)
- 6 Ring with projection only distally (Fig 121)
- 7 Ring budding off of base of deeper fold (Fig 118)
- 8 Double fold (Fig 119)

In roentgenograms made of the colon during the passage or, rather, retention of the barium meal one may observe the same type of segmented rings shown in Figures 118-123 and Figure 116-C. There is, however, a definite tendency for the segmental rings to be broadened as shown in Figure 116, A and B. Broad rings of segmental contraction of this type show the possibility but not probability of the other coats of the muscularis propria entering into the formation of the folds.

A localized increase in tone or partial contraction of the muscularis propria we believe is more likely to account for the appearance illustrated in Figure 123, a finding which is not uncommonly found in a local region when the colon is filled with a barium enema. A similar finding is present in the middle of the transverse colon in Figure 116-C.

The effect upon the segmental rings of the extensive waves of contraction (the waves which Case has described) which move forward a large amount of the contents of the colon gives us a great deal of information regarding the nature of the segmental rings. These extensive waves of contraction begin in the ascending colon or in the region of the hepatic flexure. The contraction may extend for variable distances, to the middle of the transverse colon or into the descending colon. From the evidence which we have assembled, the relaxation of the contracted gut is in the reverse direction from which the contraction occurred. For a long time we have desired to study this phenomenon by roentgenocinematography, but as yet have not gotten to it. These waves of contraction are infrequent in occurrence and cannot be accurately anticipated. However, during the making of serial roentgenograms of the colon we have recorded the appearance of the colon in local regions before, during, and after this phenomenon has occurred, and from these records we have obtained much valuable information and are able to state that the following changes may occur in the colon:

- 1 When an extensive contraction of the muscularis propria occurs the segmental rings are not completely obliterated. As soon as the most intense force of the contraction is spent, the segmental rings can be recognized as flattened segments which give a grossly serrated appearance to the margin of the contracted gut (Fig 124 and Fig 116-D). Before we recognized

The segmental folds 1, 3, 4, 5, and 6 show a definite variation in form and 1 and 4 show a marked variation in depth. Fold 2 disappears and is replaced by two folds in a different location (*D* and *E*). At *A*, *A'*, *B*, and *C* there are shallow folds which are not constant and are differently situated in the several roentgenograms.

It is our opinion that these folds act functionally to break up into variable segments the fecal contents of the colon so that the mucosa is brought into contact with different, varying parts of the fecal material. We do not believe that they exert any function in moving the contents of the colon from one region to another.

THIRD FUNDAMENTAL FINDING

(Pliability of the mucosa to peristalsis)

The third fundamental finding is the pliability of the mucosa to peristalsis. This finding is comparable with the waves of the sea as they are interrupted by floating objects, particularly by flat cakes of ice (Fig. 68)—hard, malignant or non-malignant areas, like flat cakes of ice, interfere with the gastro-intestinal peristalsis. This finding is the most delicate of the four and it requires serial roentgenography for its application to early lesions. Use of this finding necessitates the presence of peristaltic contractions which are repeated at sufficiently frequent intervals so that roentgenographic records may be made which will show whether peristaltic contractions pass through a certain section of the gut in a normal manner, or whether they are obstructed by an area of infiltration which has rendered the wall of the gut non-pliable. Reversely considered, the presence of normal peristaltic contractions is of equal importance in that it rules out the presence of infiltration sufficiently deep to interfere with the contracting muscle.

Esophagus.—Under ordinary conditions of examination, particularly with the patient in the erect posture, peristaltic contractions of the esophagus are infrequent and not prominent. Examination of the patient in the recumbent position, with the hips elevated, will usually elicit peristalsis in the esophagus, as the barium bolus must then be forced up an inclined plane. Likewise, the presence of a partial obstruction will often call forth an abnormal number of peristaltic contractions.

Figure 130 shows an unusual finding in the esophagus, which is a physiological reaction to an inconstant spasm in the region of the cardia. The peristaltic contractions, as is usual, are inconstant in depth and arrangement. The slightly dilated esophagus shows the impressions of the adjacent organs so distinctly that the pliability of the wall of the esophagus as shown in the progress of the peristaltic contractions is a valuable aid in ruling out the presence of a newgrowth. This was highly essential in this case because the clinical history was indicative of a newgrowth, that is, difficulty in swallowing and a loss of 60 pounds weight in eight months.

Figure 72 shows the opposite application of this finding. There is an extremely small carcinoma involving the posterior wall of the esophagus, and the growth is not sufficiently large to produce the usual characteristic de-

distal part of the transverse colon was markedly dilated. During this time the patient did not evacuate any of the barium enema. The solid line is a tracing of the colon outline in Film No 1, the dotted line is a tracing of Film No 2, and the broken line is a tracing of Film No 4. In the stage of contraction (dotted line) the imprint in the outline of the lumen of the flattened segmental folds is clearly shown. The most interesting finding, however, is the fact that the number and distribution of the segmental folds is absolutely identical in Films No 1 and No 4. This shows most clearly that a temporary extensive contraction of the muscularis propria may take place without obliteration of the segmental folds, and that following relaxation of the contraction and with the same distension of the gut the segmental folds will have identically the same form and distribution.

3 During a period of contraction of a long segment of the colon the contour of the gut does not remain constant, although the gross outline retains the same general form. Figure 128 is a tracing of two consecutive films from the same series, as was illustrated in Figure 126. A time interval of approximately 30 seconds elapsed between the making of these consecutive films. In this interval of time no change has taken place in the gross form of the outline of the colon, the indentations due to the segmental folds remaining present and changing only slightly in form. There are, however, many slight variations in the finer details of the outline. These changes may be due to varying degrees of tension in the muscularis propria.

4 At the actively contracting end of a long contraction causing a mass movement (Fig. 125, 1) the mucosa and segmental folds are thrown forward ahead of the contraction wave, the appearance being similar to the bending of tall grass as it is swept by a gust of wind. This is entirely similar to the change in appearance of the valvulae conniventes of the small intestine ahead of a broad wave of peristalsis.

From the preceding observations we can logically deduce that the segmental folds of the colon are a reduplication of the mucosa and muscularis mucosae with a core of submucosa, and that they are similar to the sulcus angularis, pyloric valve of the stomach, and the valvulae conniventes of the small intestine. Further, likewise, analogous to these other structures, we believe that the segmental folds of the colon are the product of an active contraction of the one continuous muscle layer included within them, that is, the muscularis mucosae.

That the segmental folds may remain unchanged, even though extensive changes occur in the muscularis propria, has been illustrated in Figure 127. The question naturally arises as to what spontaneous changes do occur in these folds and whether they progress either distally or proximally in the long axis of the colon. As regards the second question, we do not have sufficient evidence as yet to establish whether or not there is any peristaltic action of the segmental folds. The first question is partially answered by a study of Figure 129, which is a group of four tracings of the outline of the distal part of the transverse colon as shown in four of a series of seven films made during a time interval of several minutes.

The segmental folds 1, 3, 4, 5, and 6 show a definite variation in form and 1 and 4 show a marked variation in depth. Fold 2 disappears and is replaced by two folds in a different location (*D* and *E*). At *A*, *A'*, *B*, and *C* there are shallow folds which are not constant and are differently situated in the several roentgenograms.

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Figure 72 shows the opposite application of this finding. There is an extremely small carcinoma involving the posterior wall of the esophagus, and the growth is not sufficiently large to produce the usual characteristic de-

formity of the contour of the esophagus. The non-pliability of the wall in this area, as shown by the fact that the peristaltic contractions do not pass through this region, establishes a positive diagnosis of a lesion infiltrating the wall of the esophagus. The roentgenographic diagnosis of carcinoma was corroborated by esophagoscopy.

Stomach.—The third fundamental roentgenologic finding is of greatest value in study of the stomach. In this organ the peristaltic contractions normally recur in definite and frequently repeated cycles. A series of roentgenograms made of the stomach within a short period of time will record the pliability of the gastric wall. By matching one film over another one can determine accurately the slightest variation in contour of the gastric wall as it reacts to the peristaltic contractions. Serial roentgenography in several positions and projections will show definitely whether the various surfaces of the gastric wall are pliable (Fig. 5), or whether the peristaltic contraction is obstructed by an area of infiltration, malignant (Fig. 131) or non-malignant (Fig. 132). An old but simple method of demonstrating the pliability of the gastric wall is shown in Figure 133. With this method, two or three exposures are made on the same film while the patient maintains his position and holds his breath. The exposures are made at intervals of from 2 to 4 seconds, and each exposure is one-half or one-third of the normal exposure.

The application of this method to very slight areas of induration is a most delicate procedure and serial roentgenography is essential to detect a lack of pliability in a small section of the gastric wall due to an early carcinoma. This finding is especially valuable in detecting the presence of a diffusely infiltrating cancer which involves the entire lesser curvature of the stomach without producing any gross deformity of its contour. This type of lesion frequently escapes detection because of the lack of characteristic deformity of contour and yet the absence of peristalsis is strongly diagnostic.

Small shallow ulcers of the stomach which involve only the mucosa produce a local rigidity of the gastric wall, but this rigid area is so small that it does not disturb the pliability of the adjacent gastric wall. The ulcer, therefore, changes its position in relation to the peristaltic contractions as shown in Figures 97 and 100.

In the pyloric canal one observes a similar disturbance of contraction due to infiltration of the gastric wall. The relation is somewhat different in this region because the contraction of the pyloric canal is a progressive concentric contraction instead of a progressive peristaltic contraction. The small carcinoma shown in Figure 135 and which involves the lesser curvature side of the pyloric canal, was successfully diagnosed roentgenographically and the positive diagnosis of cancer was based on the constant lack of pliability in a local region of the lesser curvature side of the pyloric canal. A chronic spasm of the pyloric canal, which may produce a similar deformity will always show a change in contour of the lumen of the pyloric canal because the pliability of the wall is not completely lost (Fig. 136).



Fig. 66 The first fundamental finding may be likened to one walking around a tree, examining its bark and noticing whether it is smooth or rough, bulged as by a growth, or barked as by an ulcer

Fig. 67 The second fundamental finding is well illustrated by a sandwich, that is, a double slice of bread is likened to the double layer of mucosa and the filling to the submucosa

Fig. 68 The third fundamental finding is comparable with the waves of the sea as they are interrupted by floating objects particularly by flat cakes of ice

Fig. 69 The fourth fundamental finding is comparable with the ruts in an old dirt road in the country partly filled with water and skimmed with ice, a simile not too familiar to the younger generation

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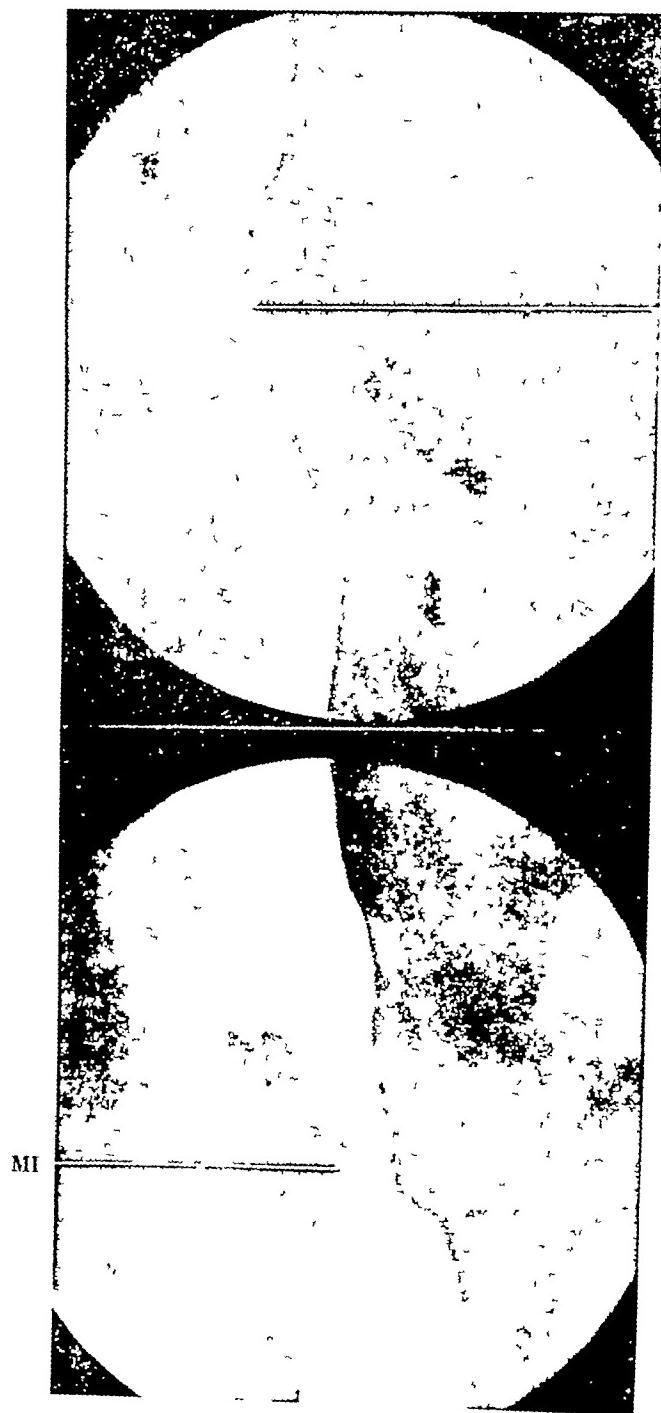
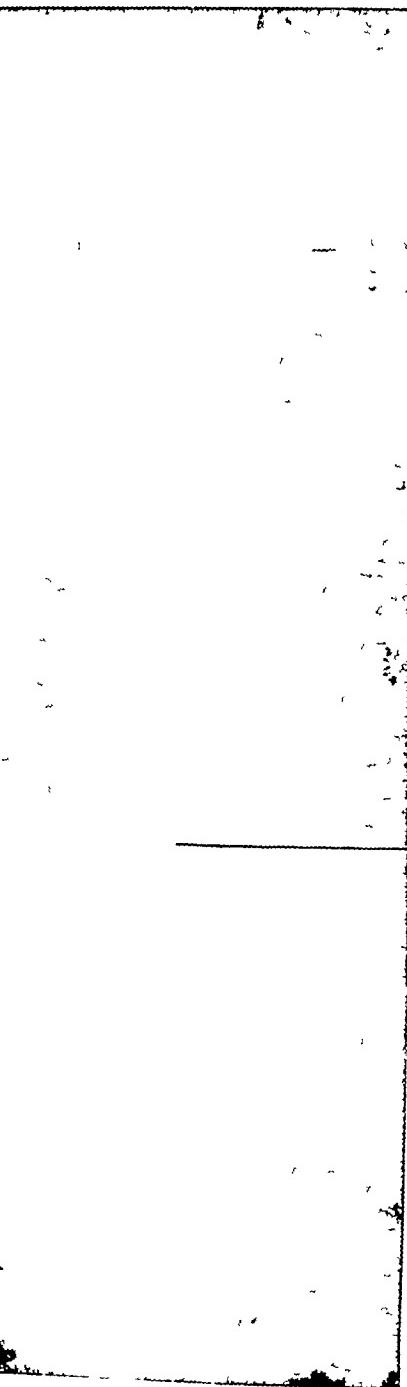


Fig 72 Roentgenograms made of the esophagus in the anteroposterior and right and left oblique directions show a small area of malignant induration (MI) of the mucosa which involves only part of the circumference of the esophagus. The malignant induration projects into the lumen and displaces the barium, giving an alteration from the normal contour. This illustrates the first fundamental finding which enables to detect a small pathologic lesion. The non-pliability of the wall of the esophagus in this area—third fundamental finding—was shown by the fact that the peristaltic contractions did not pass through this region.



Fig. 70

Fig. 71

Roentgenograms made in the postero-anterior direction (Fig. 70), and the lateral direction (Fig. 71), show the alteration in contour of the esophagus produced by a large diverticulum (*D*), which protrudes outside of the normal line of the lumen of the esophagus. The manner in which the neck (*N*) of the diverticulum arises from the posterior side of the cervical vertebra is shown in Figure 71. The esophagus is displaced forward and to the right by the body of the seventh cervical vertebra.

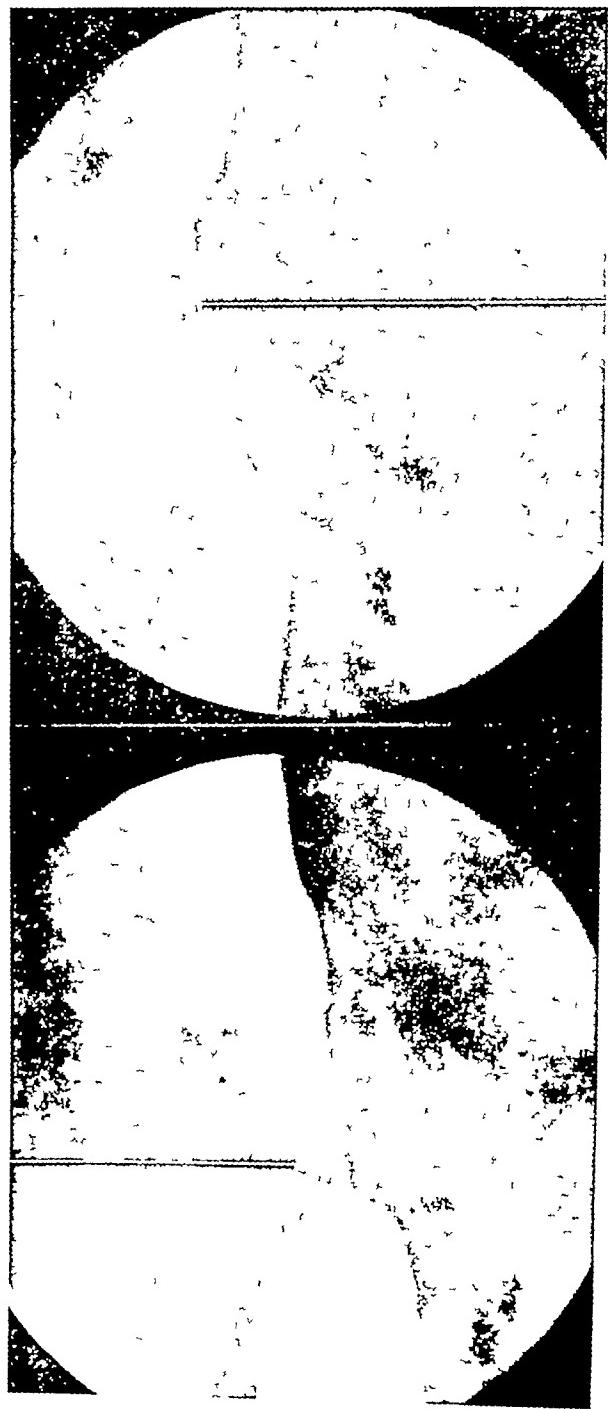
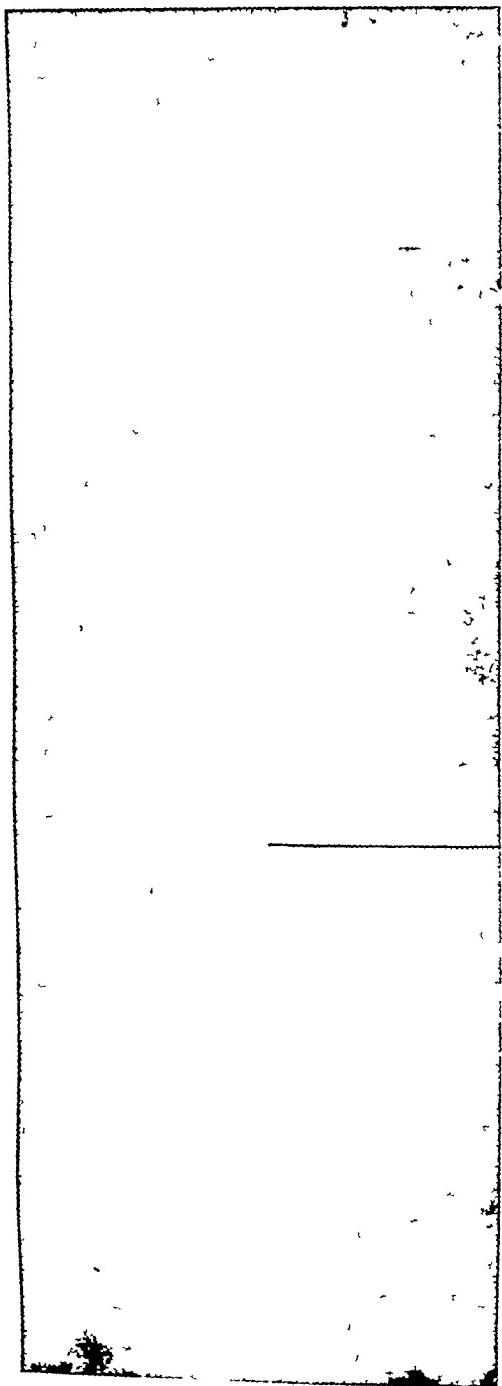
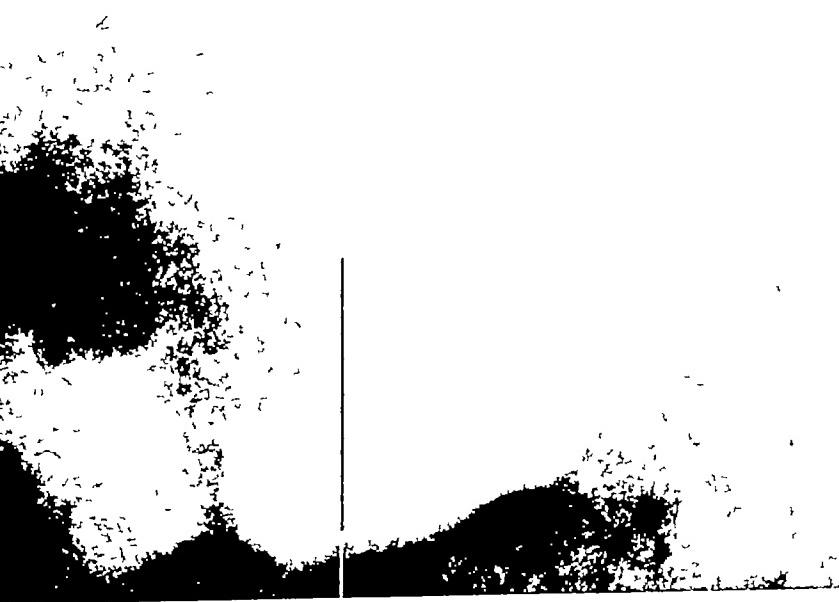


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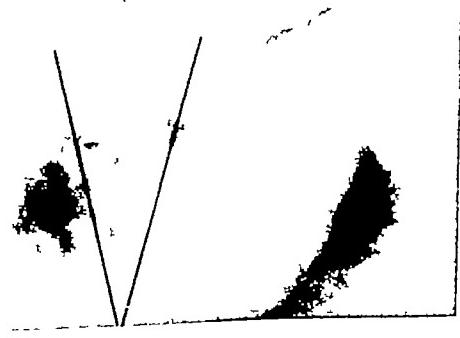


Fig 73

Fig. 73 Roentgenogram in which a growth is observed to project from the greater curvature of the antrum into its lumen. The surface of the central portion of this growth has been destroyed, resulting in an ulcer (U). This figure illustrates the manner in which the induration (I) around a malignant ulcer projects into the lumen of the stomach. This is particularly well shown in Figure 75 which is a photomicrograph of a longitudinal section of the surgical specimen of this same case.

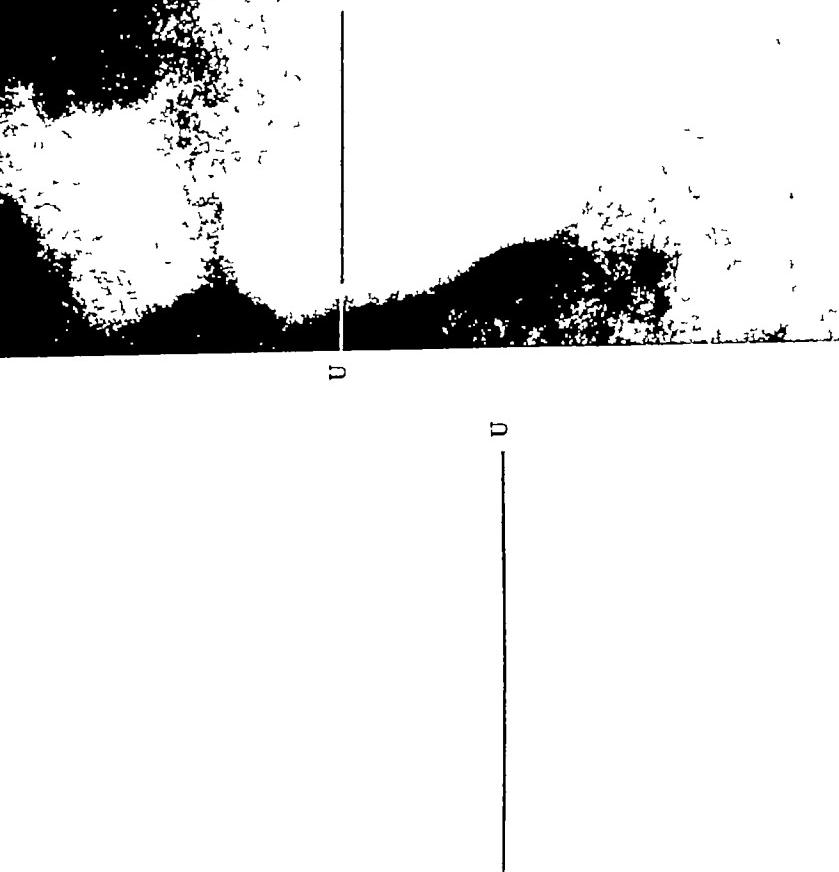


Fig. 74

Fig. 74. Roentgenogram which shows a benign ulcer (*U*) on the lesser curvature side of the antrum. The barium in the crater protrudes beyond the contour of the adjacent gastric wall. Figure 76 is a photograph of a longitudinal section of a similar ulcer.



Fig 75

Fig 75 Photograph of a longitudinal section through the malignant growth of the stomach illustrated roentgenographically in Figure 73. This shows the manner in which ulcerating malignancies project into the lumen of the stomach.

C—crater M—mucosa MP—muscularis propria, broken by the ulcer in Figure 76, not broken but infiltrated with carcinoma and retracted in Figure 75 S'—submucosa, infiltrated with carcinoma S—submucosa, connective tissue wedge P—peritoneum of serosal coat, no subperitoneal patch PP—subperitoneal patch of connective tissue in intraperitoneal gastric triangle



Fig 76

Fig 76 Photograph of a longitudinal section through a gastric ulcer similar to the ulcer shown roentgenographically in Figure 74. The crater of this benign ulcer protrudes beyond the contour of the adjacent gastric wall.

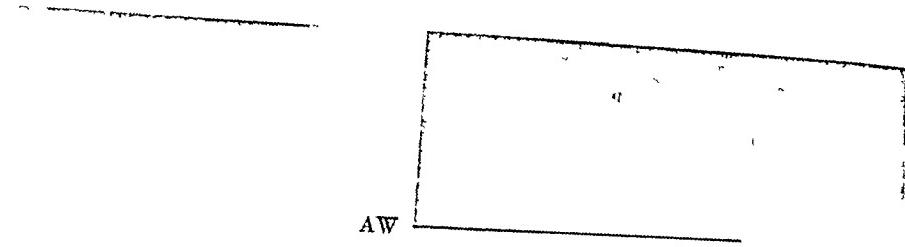


Fig. 78 Ulcer of the cap. The crater of the (U) protrudes beyond the margin of the

of a cap of otherwise normal appearance

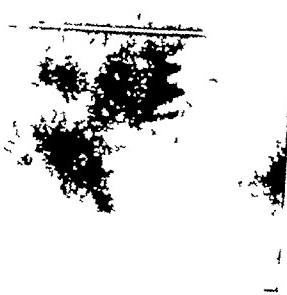


Fig. 79 Ulcer of the cap. The posterior surface of the cap is normal in contour except for the crater of an acute ulcer (U). The crater protrudes beyond the normal contour of the lumen. The expansion of the anterior wall of the cap (AW) is limited by recently formed peritoneal adhesions. This roentgenographic examination was made 4½ hours after the onset of symptoms

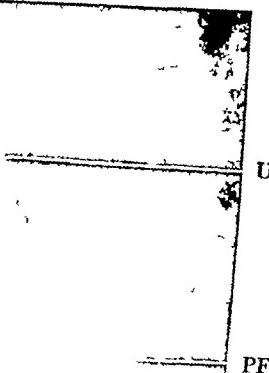


Fig. 80

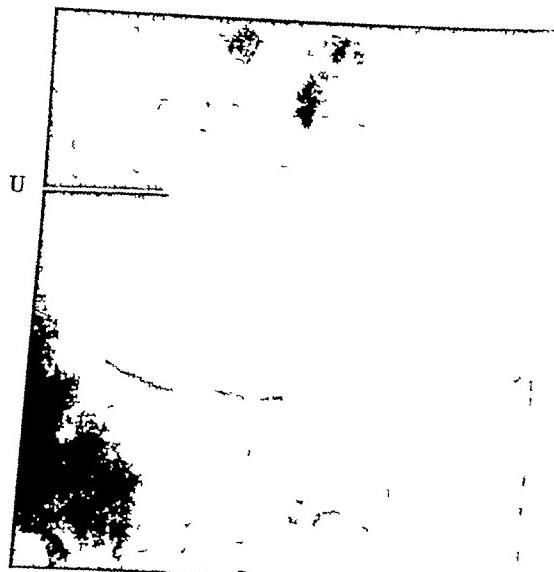


Fig. 81

Fig. 80 and 81 are roentgenograms which show the manner in which the crater of an ulcer (U) of PF—prepyloric fold.



Fig. 82



Fig. 83



Fig. 84



Fig. 85

Figs. 82-85 are roentgenograms which show alterations in the contour of the cap by changes which encroach upon the lumen. Fig. 82 shows an infolding of the entire thickness of the wall of the cap by a veil or band of adhesions. Fig. 83 shows the projection into the lumen of the cap caused by the induration around an ulcer. Fig. 84 shows the irregular deformity of the lumen of the cap caused by multiple bands of scar tissue. Fig. 85 shows the projection into the lumen caused by bands of scar tissue, and also shows the protusion beyond the normal contour of the dilated uninvolved portion of the cap proximal to an area of stenosis.



Fig. 86



Fig. 87



Fig. 88



Fig. 89

Figs. 86-89 are roentgenograms of four cases which show diverticula of the duodenum and the manner in which the diverticula protrude beyond the normal contour of the duodenum. Fig. 86 Four diverticula arising from the superior side of the transverse duodenum. Fig. 87 A diverticulum arising from the right side of the ascending duodenum. Fig. 88 A diverticulum arising from the left side of the descending duodenum adjacent to the papilla of Vater. Fig. 89 A large diverticulum arising from the superior side of the duodeno-jejunal flexure.



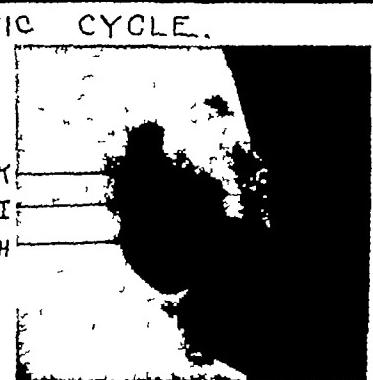
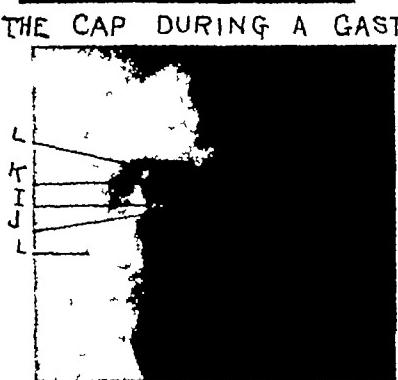
N° 1 ILEUM & JEJUNUM

N° 26 SEEDS US SHAPED "CAPS".

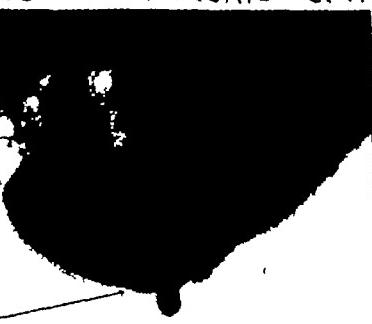


N° 7 CAP PRONE POST.

N° 8 CAP

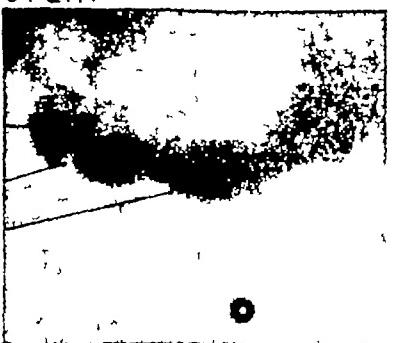


N° 13 14 ANGULATIONS OF PYLORIC SPHINCTER.



N° 19-20. VARIATION OF THE SPHINCTER = C4

N° 28 TEXTBOOK STOMACH



N° 24 COW-HORN STOMACH



BAG

TUBE

BAG

TUBE

TUBE

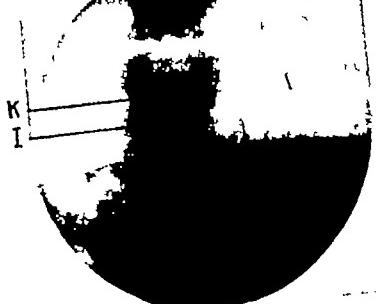


Fig. 86

THIRD PORTIONS OF THE DUODENUM



ERECT POST.



Nº9 LEVEL OF CHYME IN CAP



Nº15 DISPLACEMENT OF CAP



STRIC CYCLE



Nº21 ANTRUM IN SYSTOLE

CT - SAME PATIE
EFFICIENT PERISTAL

77 "Radiographic stud
in the duodenum"

RONE
LORUS
and duodenum

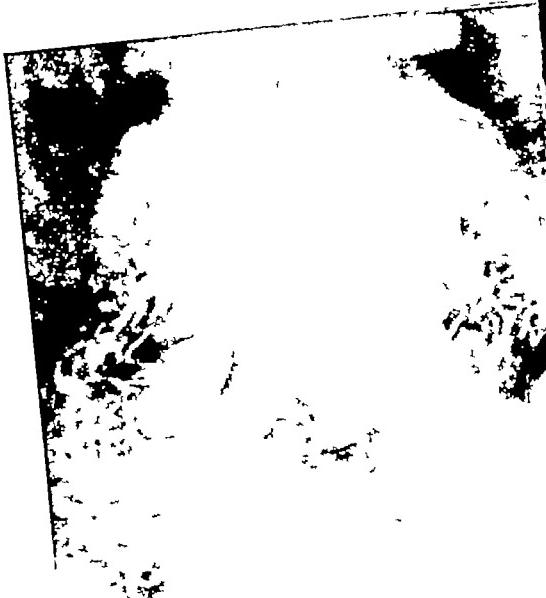


Fig. 88

Figs. 86-89 are roentgenograms of four cases in which the diverticula protrude beyond the normal from the superior side of the transverse duodenum, the ascending duodenum. Fig. 88 A diverticulum cent to the papilla of Vater. Fig. 89 A large diverticulum at the flexure

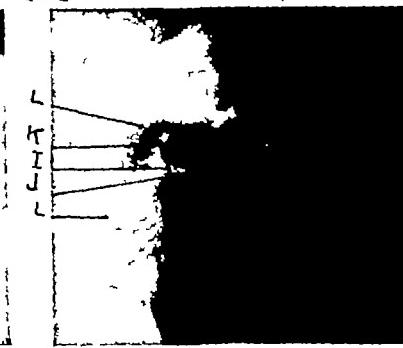
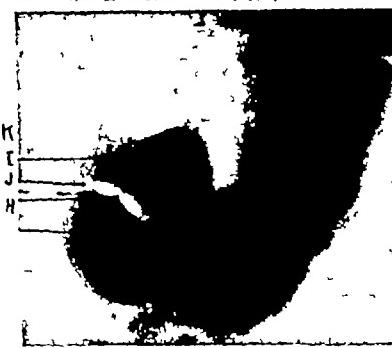


Nº 4-5-6

VARIOUS SHAPED "CAPS".



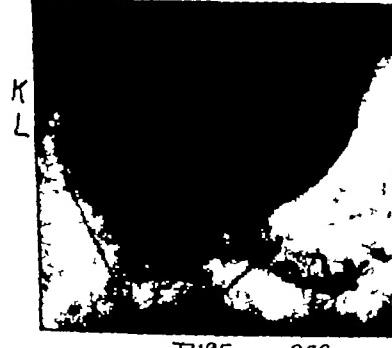
Nº 10-11-12 VARIATIONS IN THE CAP DURING A GASTRIC CYCLE



Nº 16 17 18 VARIATIONS OF PYLORIC SPHINCTER



Nº 22 ANTRUM IN DIASTOLE



TUBE BAG

Nº 23 TEXTBOOK STOMACH



BAG

Nº 24 COW-HORN STOMACH



BAG TUBE TURB

Nº 28 29 30 ARTIFICIAL

DILATATION OF THE DUODENUM

Fig. 90 Roentgenograms made one-half hour (A) and two hours (B) after ingestion of a barium meal which show multiple diverticula of the duodenum and the second and third groups of coils of the small intestine. On casual examination one might consider that the overlapping shadows of the diverticula as shown in B were due to a filled colon.

A



B



CAT
UP



Fig. 91. Tuberculous coils of the small intestine. The terminal coil of the sixth group of coils is constricted by a tuberculous tumor (*T*). Diagnosis confirmed by operation. *T*—dilated coil or terminal ileum formed by adhesions. *S*—sigmoid sixth group of coils displaced by adhesions.

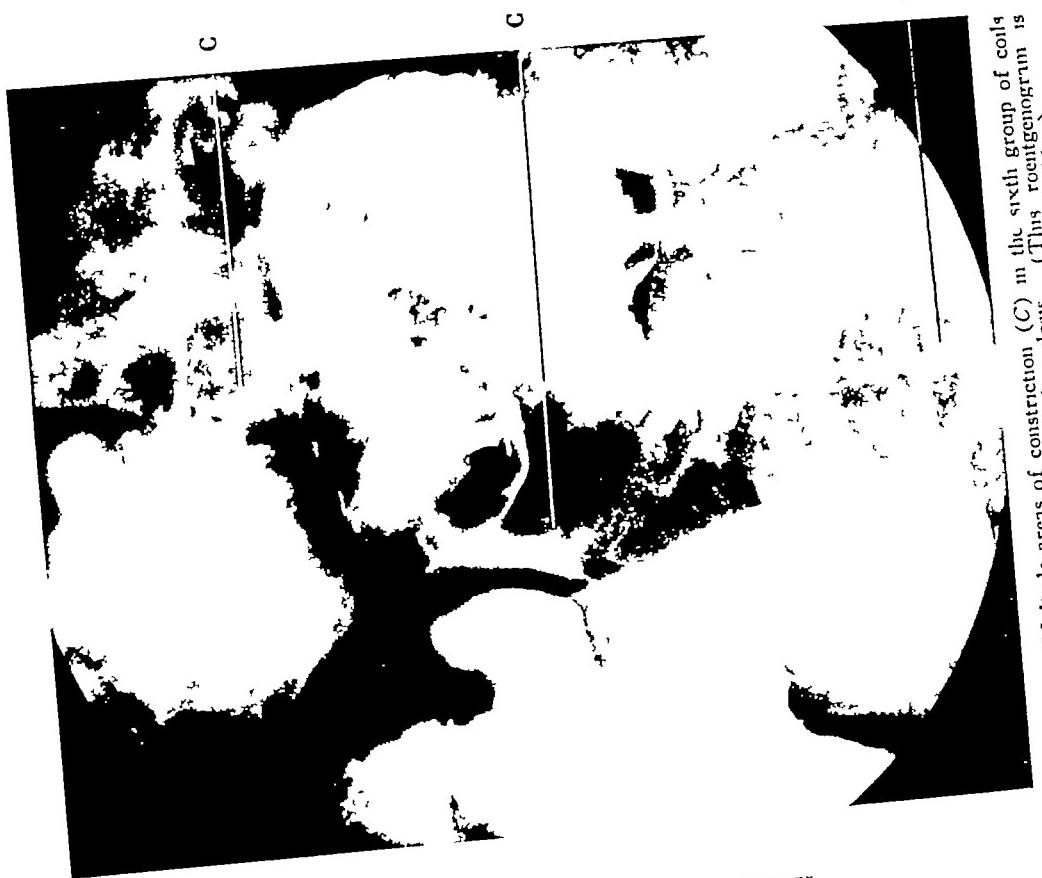


Fig. 92. Multiple strictures (constrictions (*C*) in the sixth group of coils of the small intestine caused by tuberculous (*Thrix roentgenogramm* is reproduced through the courtesy of the late Webster W. Bulden).

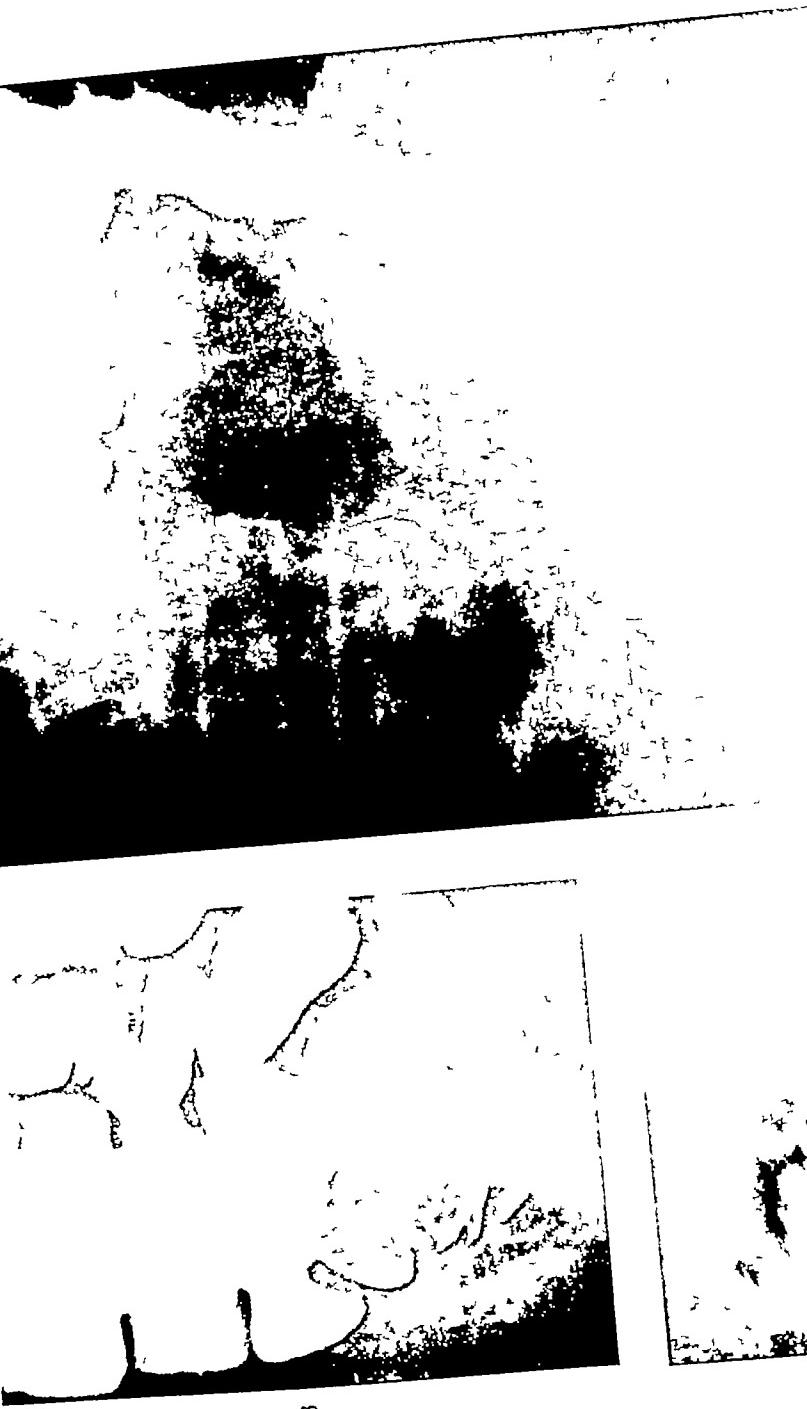


Fig 93

Fig 94

Fig 95

Fig. 95 Roentgenogram which shows the manner in which diverticula of the descending and sigmoid colon protrude beyond the normal contour of the gut

Figs. 93 and 94 are roentgenograms which show the manner in which an adenocarcinoma of the cecum protrudes into the lumen of the gut by the displacement of the barium. Fig. 93 shows the growth of the growth, and Fig. 94 shows the growth surrounded by air.



Fig. 92. Multiple areas of constriction (C) in the sixth group of coils of the small intestine caused by tuberculosis (T). (This roentgenogram is reproduced through the courtesy of the late Webster W. Bulden.)

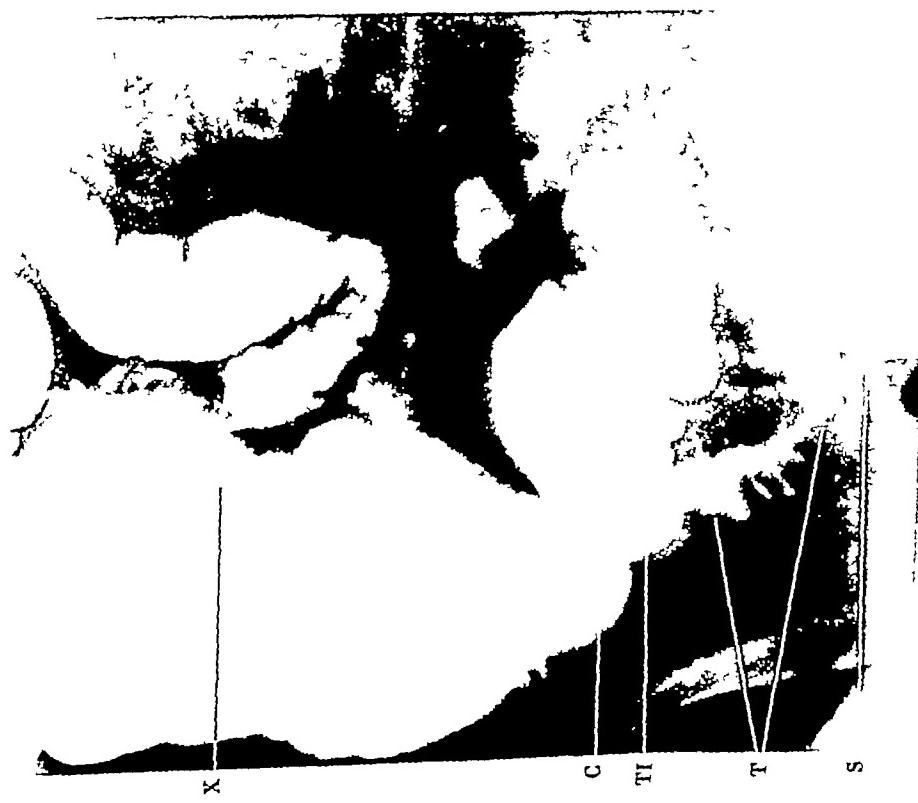


Fig. 91. Tuberculosis of the small intestine. The terminal coil of the sixth group of coils is constricted by a tuberculous (T). Diagnosis confirmed by operation. X—dilated coil or terminal ileum. C—cecum. S—sigmoid. X—sixth group of coils displaced by adhesions.



Fig. 97



Fig. 98



Fig. 99



Fig. 100

Figs 97-100 are four of a series of roentgenograms which show a small mucosal ulcer in the region of the sulcus angularis. There is not sufficient induration around the ulcer to interfere with peristalsis and as a result the crater of the ulcer rides with the wave. In Fig 97 the crater is in the distal surface of the peristaltic wave at the sulcus. In the succeeding figures the peristaltic wave has moved pyloruswards and the crater is successively at the tip of the wave (Fig 98), in the proximal surface of the wave (Fig 99), and proximal to the wave (Fig 100).



Fig. 96 Sulci angulares of several cases and of different stages of the same case 1, 2, 3 4, 5, 6—types of sulci observed in different cases 7, 8, 9—the sulcus of the same case at different stages of the cycle *A*—diastole *B*—systole *C*—the pyloric canal closed

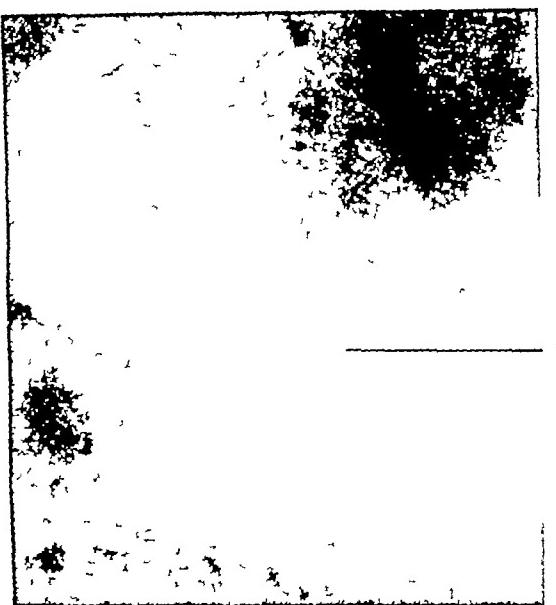


Fig 103 Roentgenogram which shows a small shallow ulcer (*U*) involving the proximal surface of the lesser curvature side of the pyloric valve. The induration around the crater has thickened the lesser curvature side of the valve

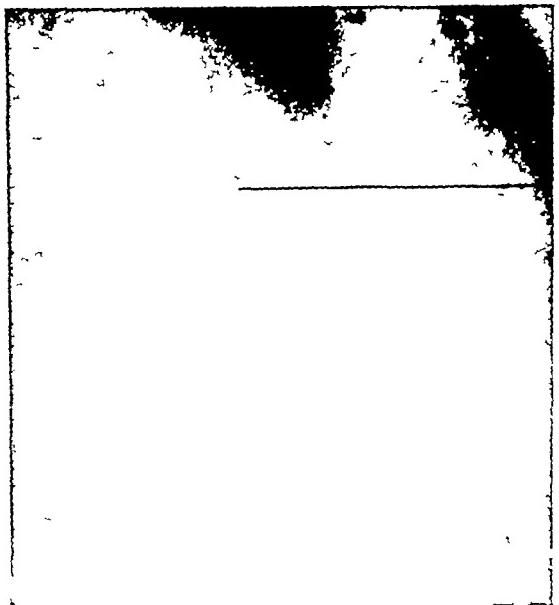


Fig 104 Roentgenogram which shows an ulcer (*U*) in the middle of the pyloric valve. The induration extends into the wall of both the stomach and cap so that the lesser curvature side of the valve is obliterated and there is flattening of the contour of the adjacent parts of the stomach and cap. The residual deformity which was present after this ulcer was healed is shown in Figure 107

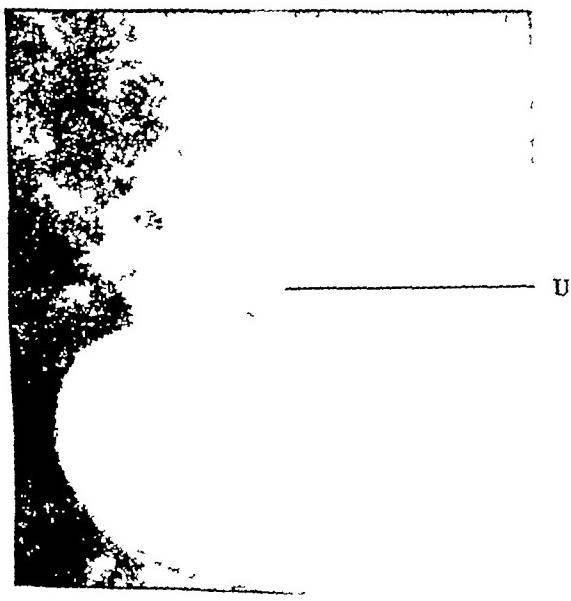


Fig 105 Roentgenogram which shows a deep ulcer (*U*) in the pyloric valve. The induration completely encircles the stomach and cap in the region of the valve



Fig 106 Roentgenogram which shows the manner in which induration around an ulcer (*U*) of the antrum may extend across the pyloric valve and produce a flattening of the contour of one side of the valve and the adjacent part of the cap

Fig. 102 Roentgenogram which shows an ulcer in the region of the sulcus angulans which is sufficiently deep to involve the muscularis propria. The crater and the surrounding area of infiltration have obliterated the sulcus angulans.



Fig. 101 Roentgenogram which shows a small submucosal ulcer in the sulcus angulans. The induration around the ulcer has increased the width of the proximal surface of the sulcus angulans.





Fig 111 Roentgenogram which shows an annular carcinoma of the antrum which has developed adjacent to the proximal side of the pyloric valve. The growth does not extend into the wall of the cap. At the base of the cap there is a small indentation where the valve protrudes slightly into the cap



Fig 112 Roentgenogram which shows an extensive carcinoma simplex involving practically all of the stomach except the portion adjacent to the pyloric valve

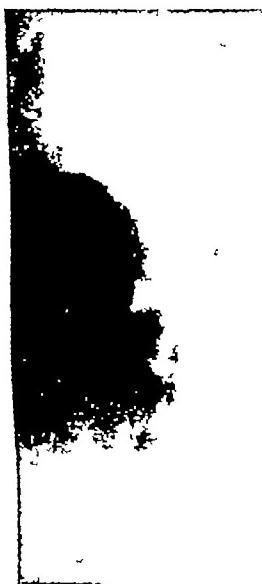


Fig 113



Fig 114

Figs 113 and 114 are roentgenograms made in the prone and erect postures which show a bulky adenocarcinoma involving the antrum of the stomach. The tumor extends close to the pyloric valve but does not involve it or extend into the wall of the cap



Fig 107



Fig 108

Figs 107 and 108 are roentgenograms which show the flattening of the lesser curvature side of the pyloric valve and adjacent parts of the stomach and cap which remains after healing of a deep ulcer of the pyloric valve. Fig 107 is the same case as shown in Figure 104 after an interval of 48 days.

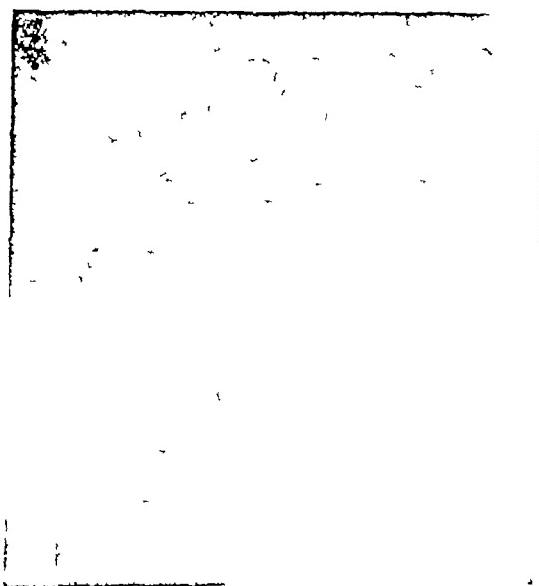


Fig 109 Roentgenogram which shows a funnel-shaped carcinoma of the antrum which extends to the pyloric valve. The contour of the cap side of the valve is normal and the lumen of the valve is centric to the lumen of the cap and the lumen of the constricted antrum



Fig 110 Roentgenogram which shows an annular carcinoma of the pyloric canal. The growth does not extend into the wall of the cap

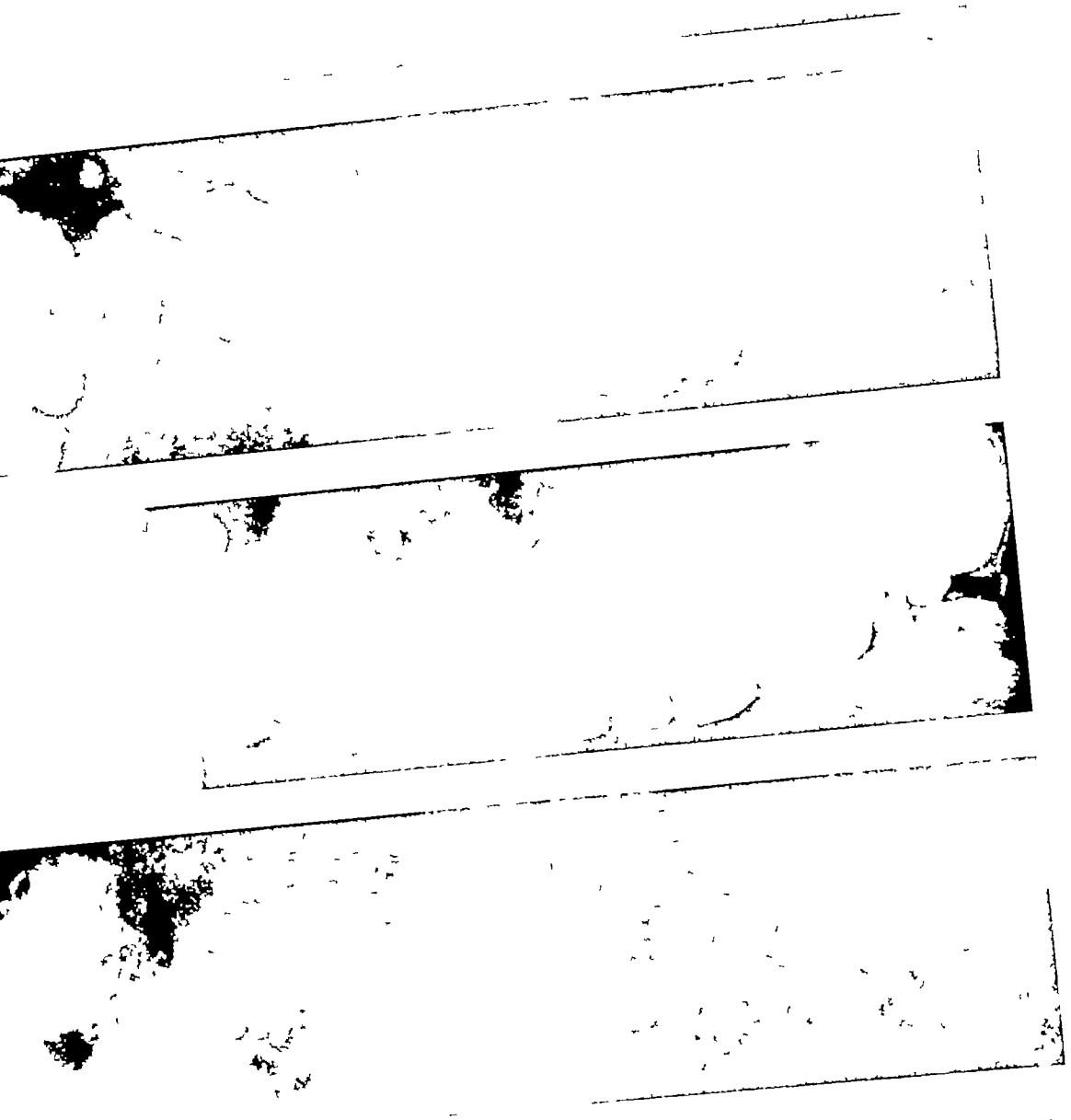


Fig 116 Roentgenograms which show the roentgenographic appearance of the segmental folds in the transverse colon *A* and *B*-24 hours after a barium meal *C*-the colon distended with a barium enema *D*-the contracted colon after evacuation of a barium enema

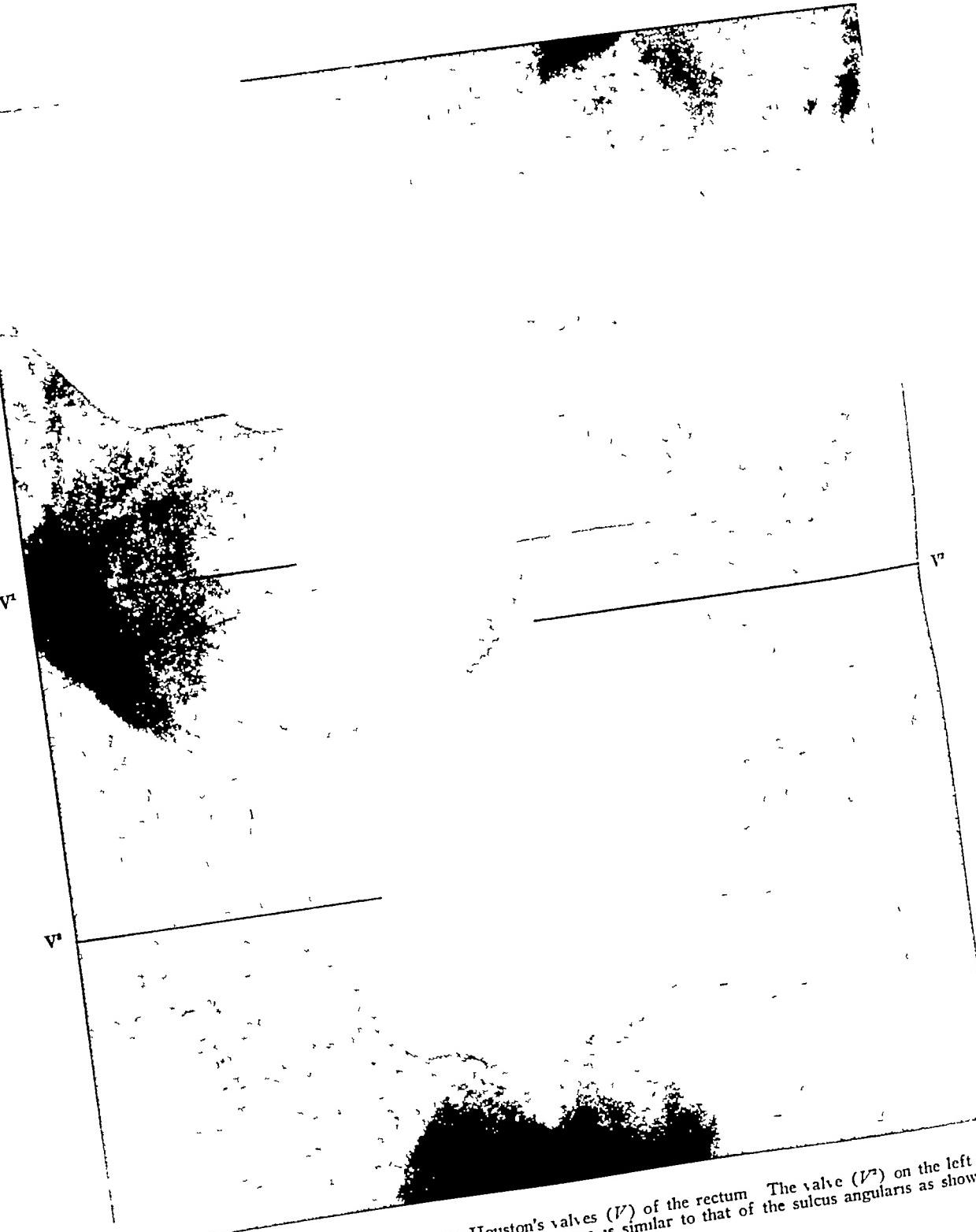


Fig 115 Roentgenogram which shows Houston's valves (V) of the rectum. Note that its appearance is similar to that of the sulcus angularis as shown in Figure 96.

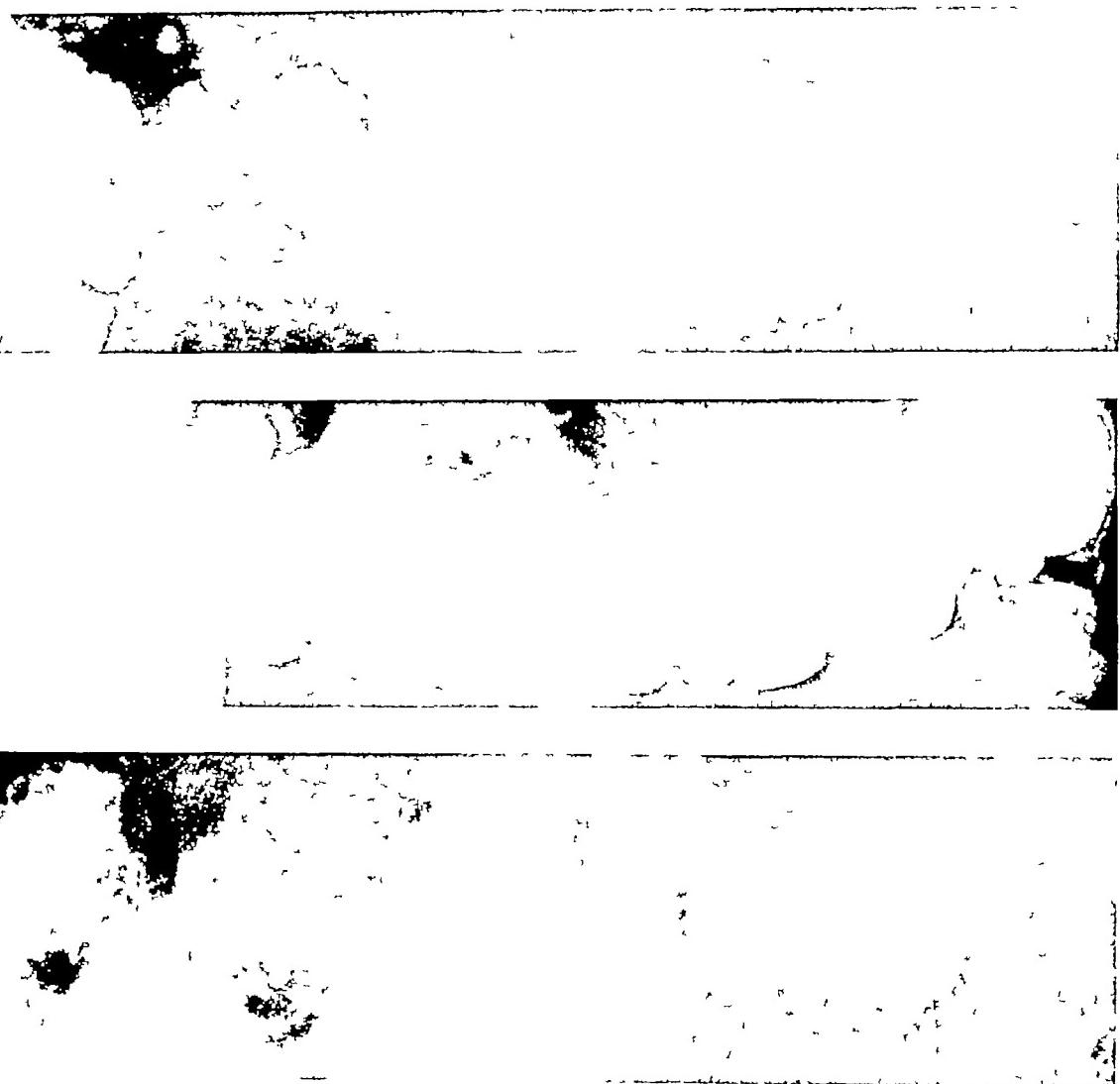


Fig 116 Roentgenograms which show the roentgenographic appearance of the segmental folds in the transverse colon *A* and *B*-24 hours after a barium meal *C*-the colon distended with a barium enema *D*-the contracted colon after evacuation of a barium enema

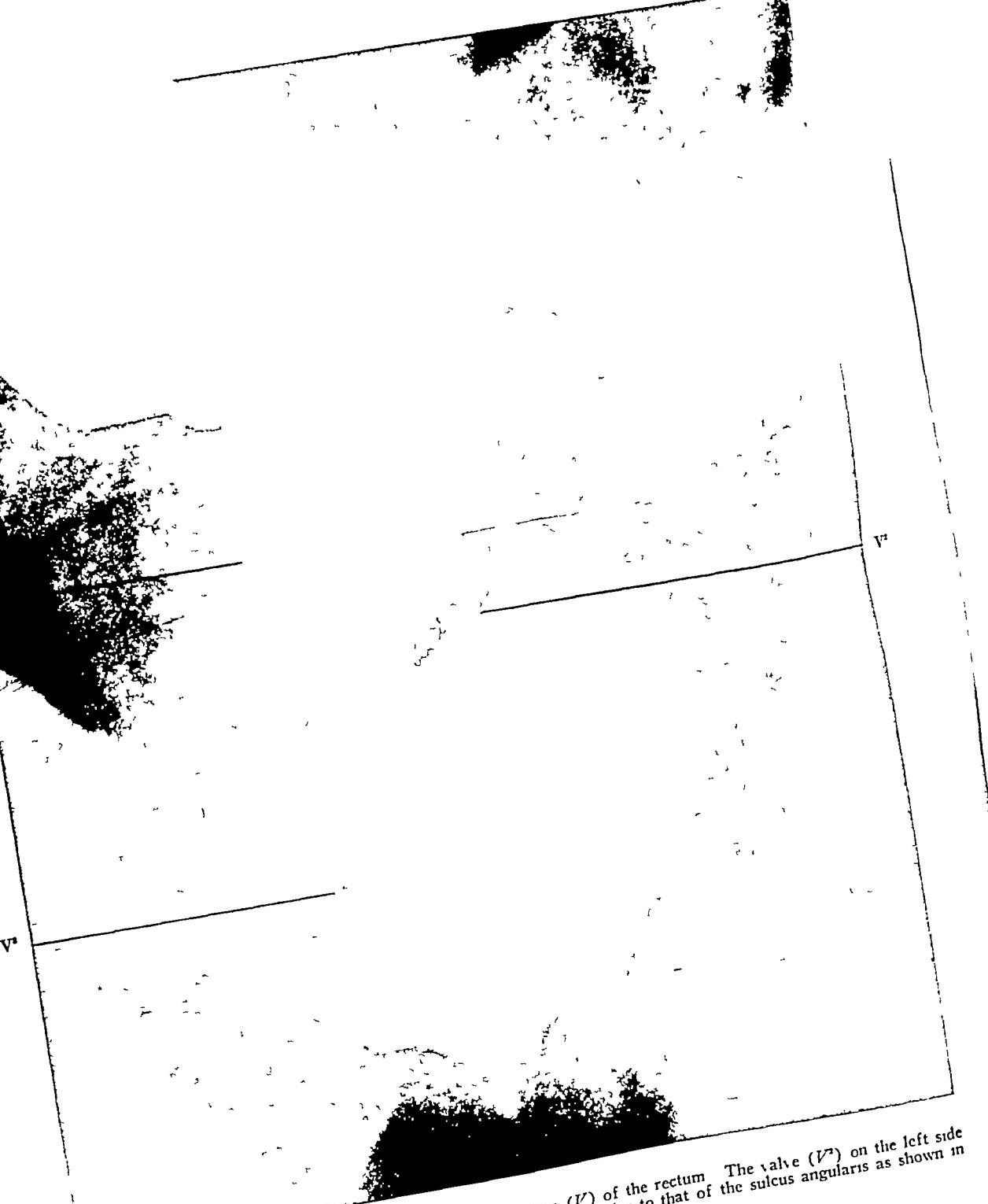


Fig 115 Roentgenogram which shows Houston's valves (V) of the rectum. The valve (V') on the left side of the rectum is viewed on edge. Note that its appearance is similar to that of the sulcus angularis as shown in Figure 96

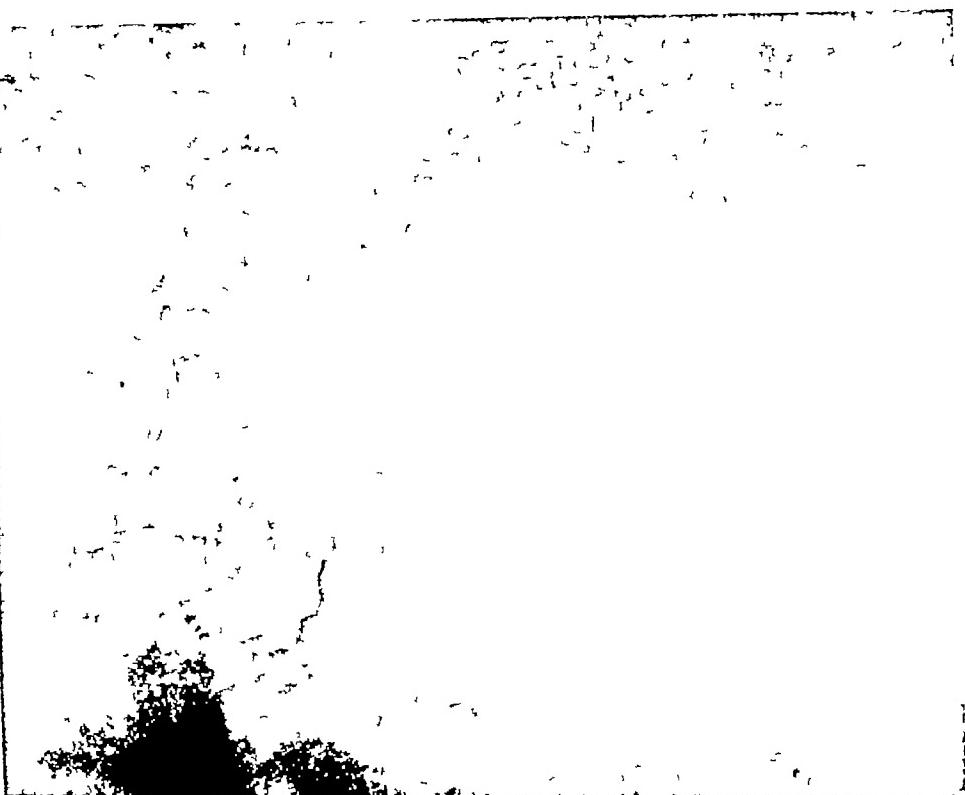


Fig. 124 Roentgenogram made after evacuation of a barium enema shows the grossly serrated contour of the lumen of the contracted colon. The gross serrations are due to the segmental folds which have been flattened out and broadened by contraction of the outer muscle wall (musculi proprii).

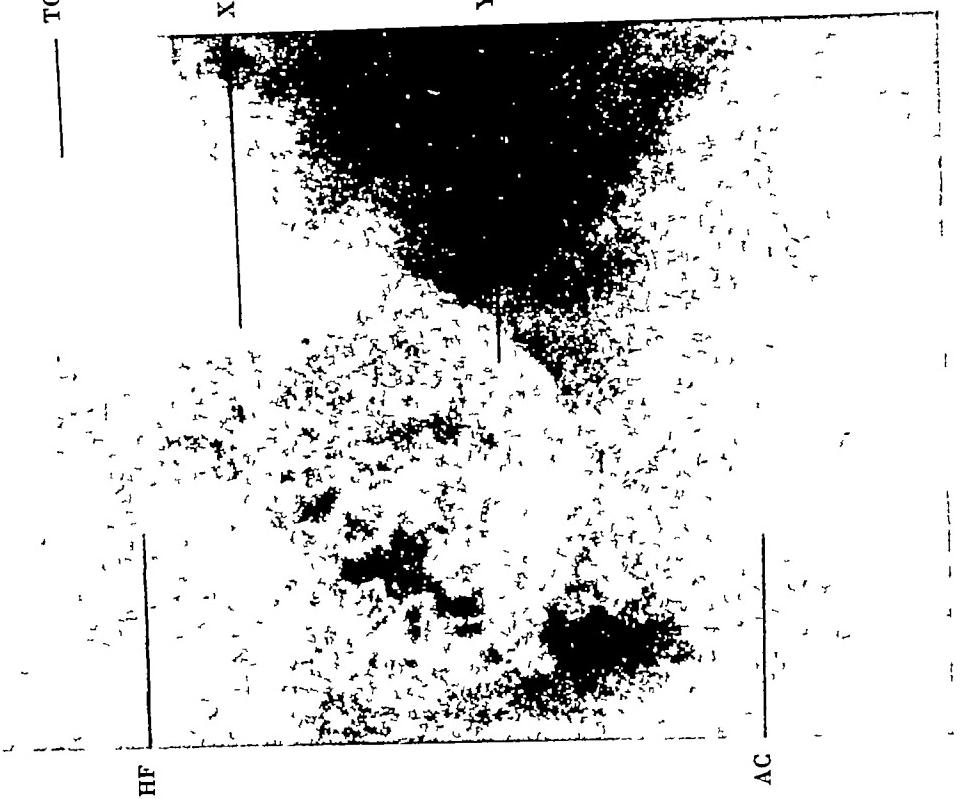


Fig. 125 Roentgenogram made of the colon during the progressive formation of a long contraction causing a mass movement. At the actively contracting end (X) the mucosal and segmental folds are thrown forward ahead of the wave of contraction, the appearance being similar to the bending of tall grass as it is swept by a gust of wind. In the area of most intense contraction (Y) the mucosa is folded longitudinally. AC—ascending colon; HF—hepatic flexure; TC—transverse colon

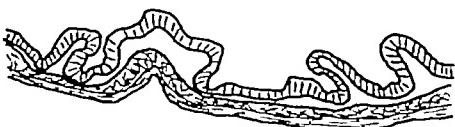
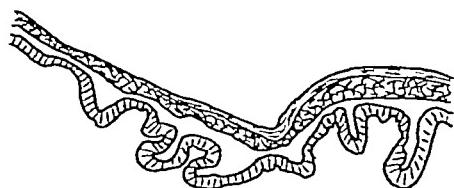


Fig 117

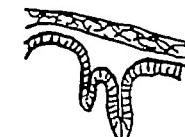


Fig 118

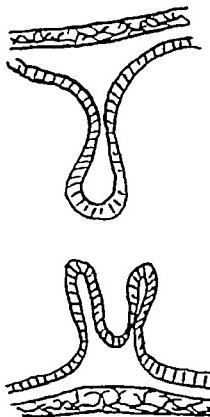


Fig 119

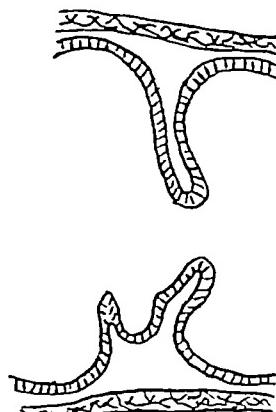


Fig 120

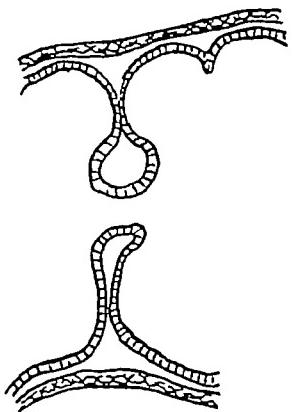


Fig 121

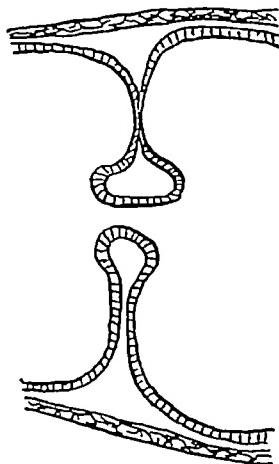


Fig 122

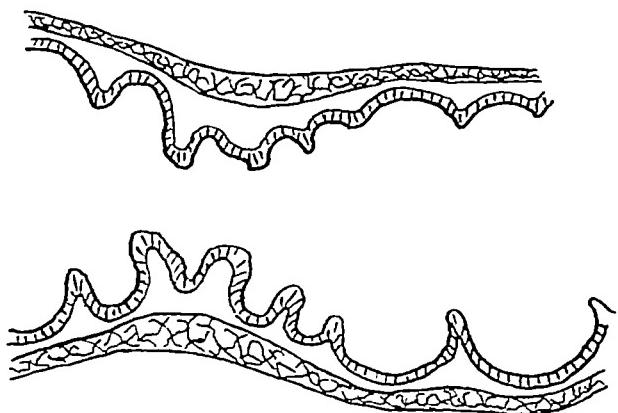


Fig 123

Fig 117 is a tracing of the outline of the coats of the colon specimen as cut longitudinally and shown in Figure 60. The tracing has been reduced to the actual size of the specimen. Using this as a model, in Figures 118-123 we have diagrammatically drawn the wall of the colon around the segmental folds as shown in the roentgenograms.

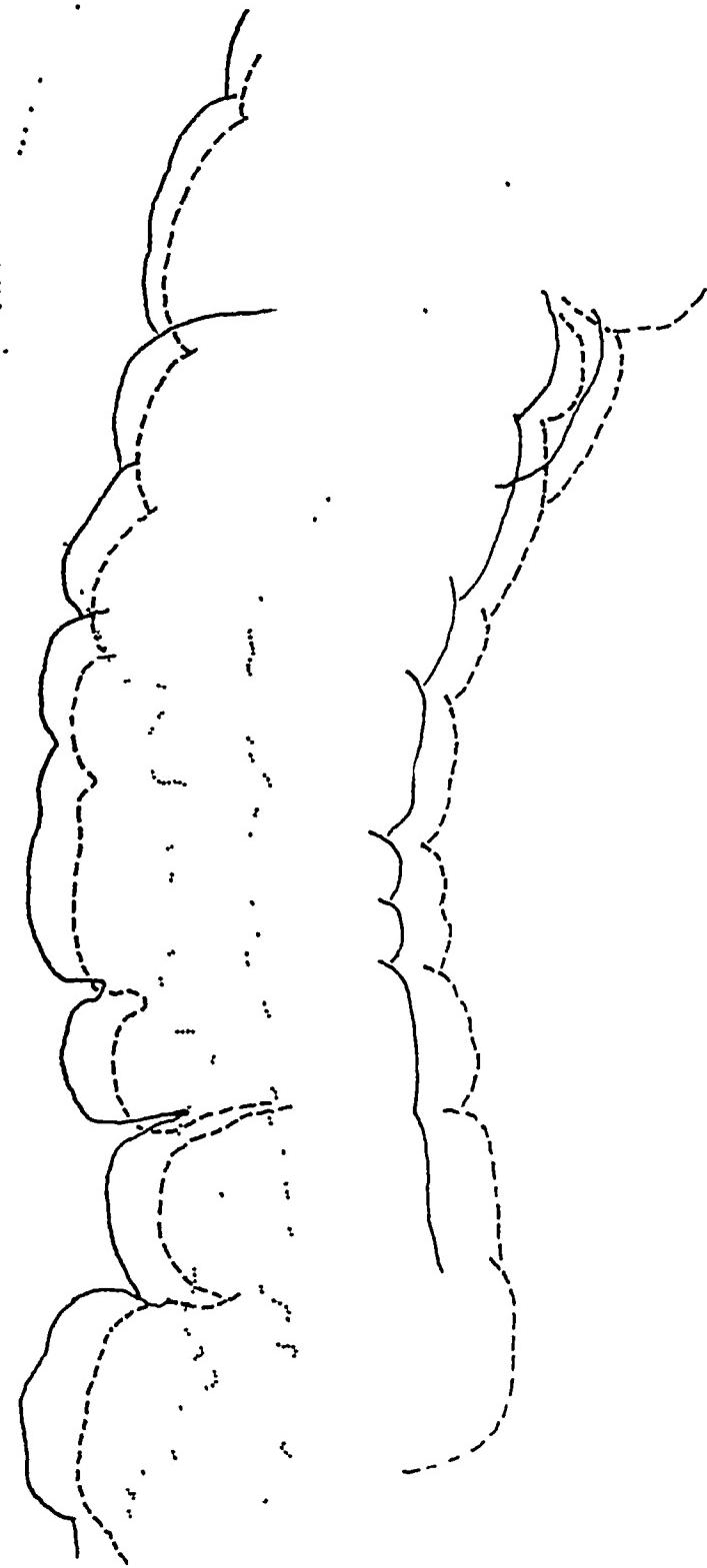


Fig 127. Tracing of the lumen of the transverse colon as shown in three roentgenograms from a series of five which were made while the colon was filled with a barium enema. The solid line is Film 1 of the series, the dotted line Film 2, and the broken line Film 4. There was a time interval of one minute between the making of Films 1 and 2, and an interval of two minutes between Films 2 and 4. Film 2 (dotted line) shows a mass contraction which occurred and relaxed during the interval of three minutes between the making of Films 1 and 4.

In the stage of contraction (dotted line) the imprint of the flattened segmental folds is clearly shown in the outline of the lumen. The most interesting finding, however, is the fact that the number and distribution of the segmental folds are absolutely identical in Films 1 and 4. This shows most clearly that a temporary extensive contraction of the muscularis propria may take place without obliteration of the segmental folds, and that following relaxation of the contraction and with the same distention of the gut the segmental folds will have identically the same form and distribution.



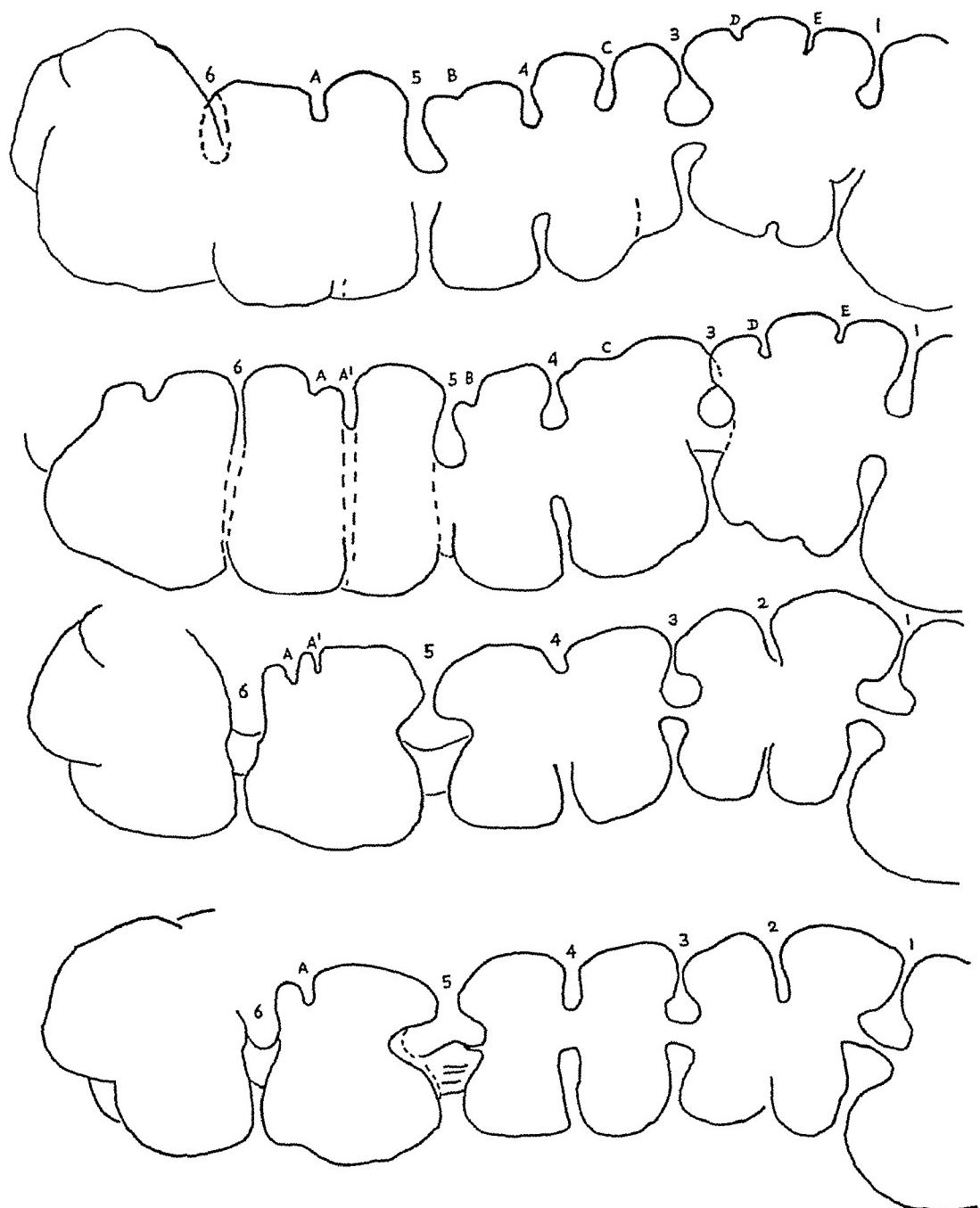


Fig. 129 Tracing of the barium outline of the lumen of the distal part of the transverse colon as shown in four roentgenograms made during a time interval of several minutes. The segmental folds 1, 3, 4, 5, and 6 show a definite variation in form, and folds 1 and 4 show a marked variation in depth. Fold 2 disappears and is replaced by two folds in a different location (D and E). At A, A', B and C there are shallow folds which are not constant and are differently situated in the several films.

Tracing of the lumen of the colon as shown in two consecutive roentgenograms from the same series illustrated in Figure 126. A time interval of approximately three seconds elapsed between the making of these two consecutive films. In this interval of time there is no change in the gross form of the outline of the colon, the indentations due to the segmental folds remaining present and unchanged. There are, however, many slight variations in the finer details of the outline. These changes may be due to varying degrees of tonus in the muscularis propria.



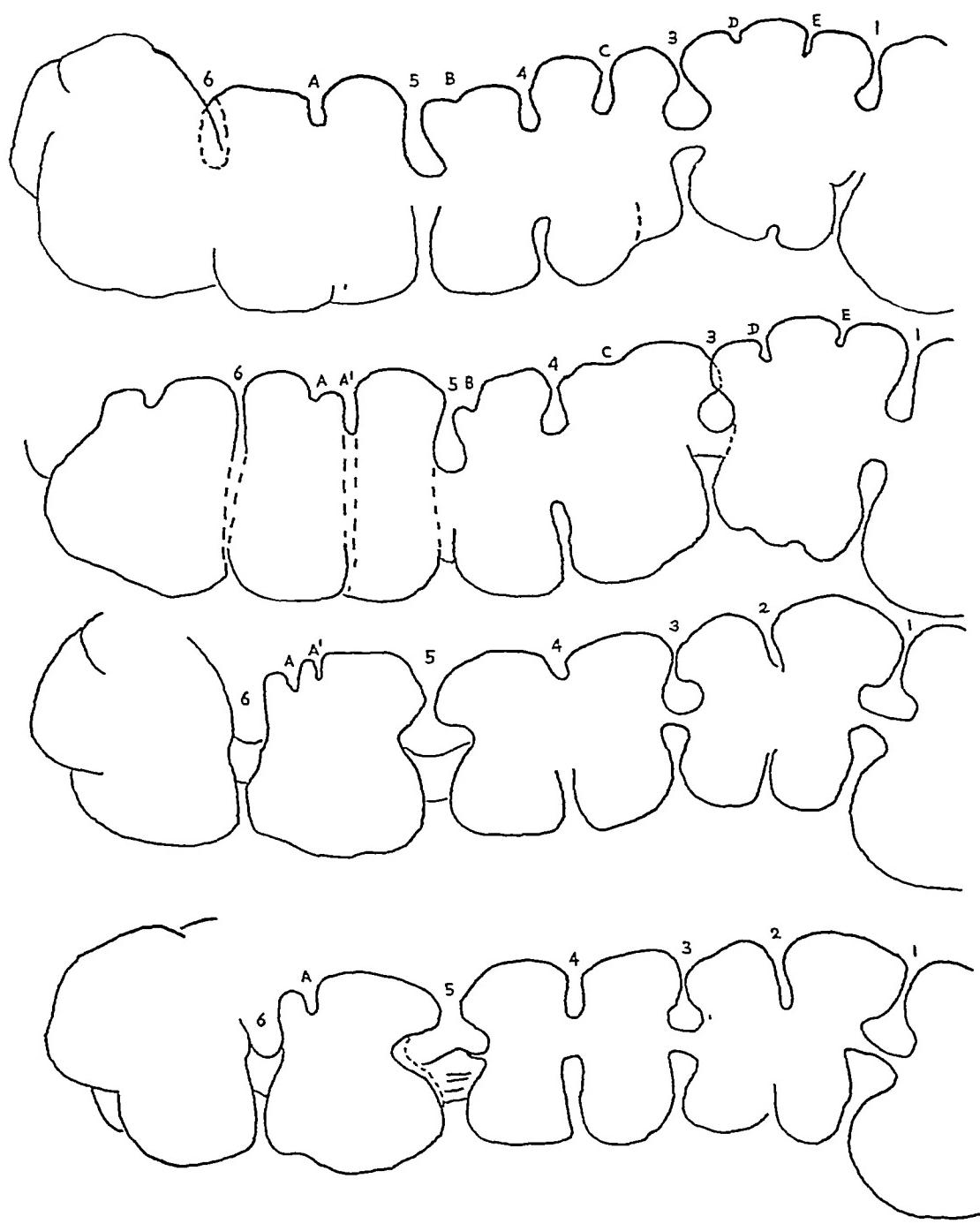


Fig 129 Tracing of the barium outline of the lumen of the distal part of the transverse colon as shown in four roentgenograms made during a time interval of several minutes. The segmental folds 1, 3, 4, 5, and 6 show a definite variation in form, and folds 1 and 4 show a marked variation in depth. Fold 2 disappears and is replaced by two folds in a different location (D and E). At 4, A¹, B and C there are shallow folds which are not constant and are differently situated in the several films.

Fig. 130. Roentgenograms made in the oblique direction with the patient in the recumbent (*A* and *B*) and erect (*C* and *D*) postures show unusually active and vigorous peristalsis of the esophagus secondary to a spasm of the esophagus at the level of the diaphragm. The absence of malignant infiltration is shown by the pliability of the wall to the peristaltic contractions. Diagnosis confirmed by esophagoscopy.



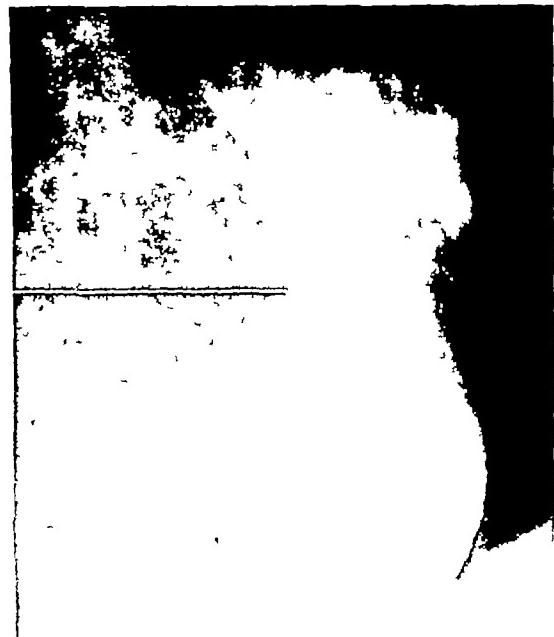


Fig 131 Two of a series of roentgenograms which show obstruction of the peristaltic contractions by an area of malignant infiltration in the upper part of the corpus of the stomach. There is an ulcerated area (*U*) in the surface of the new growth

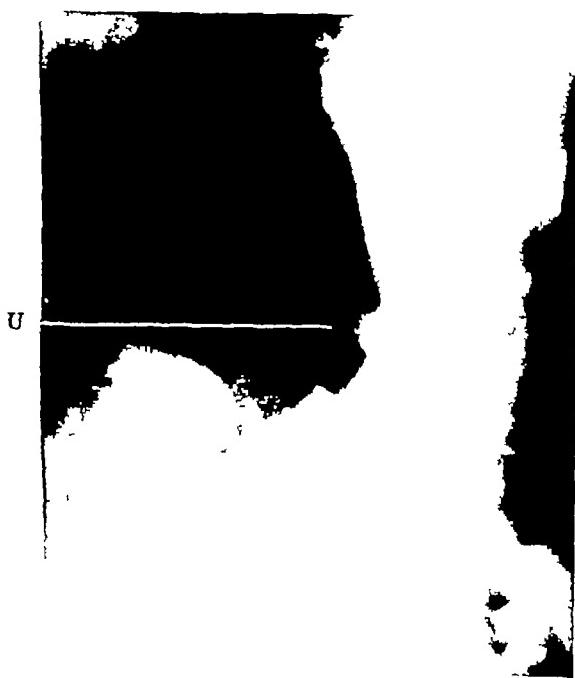
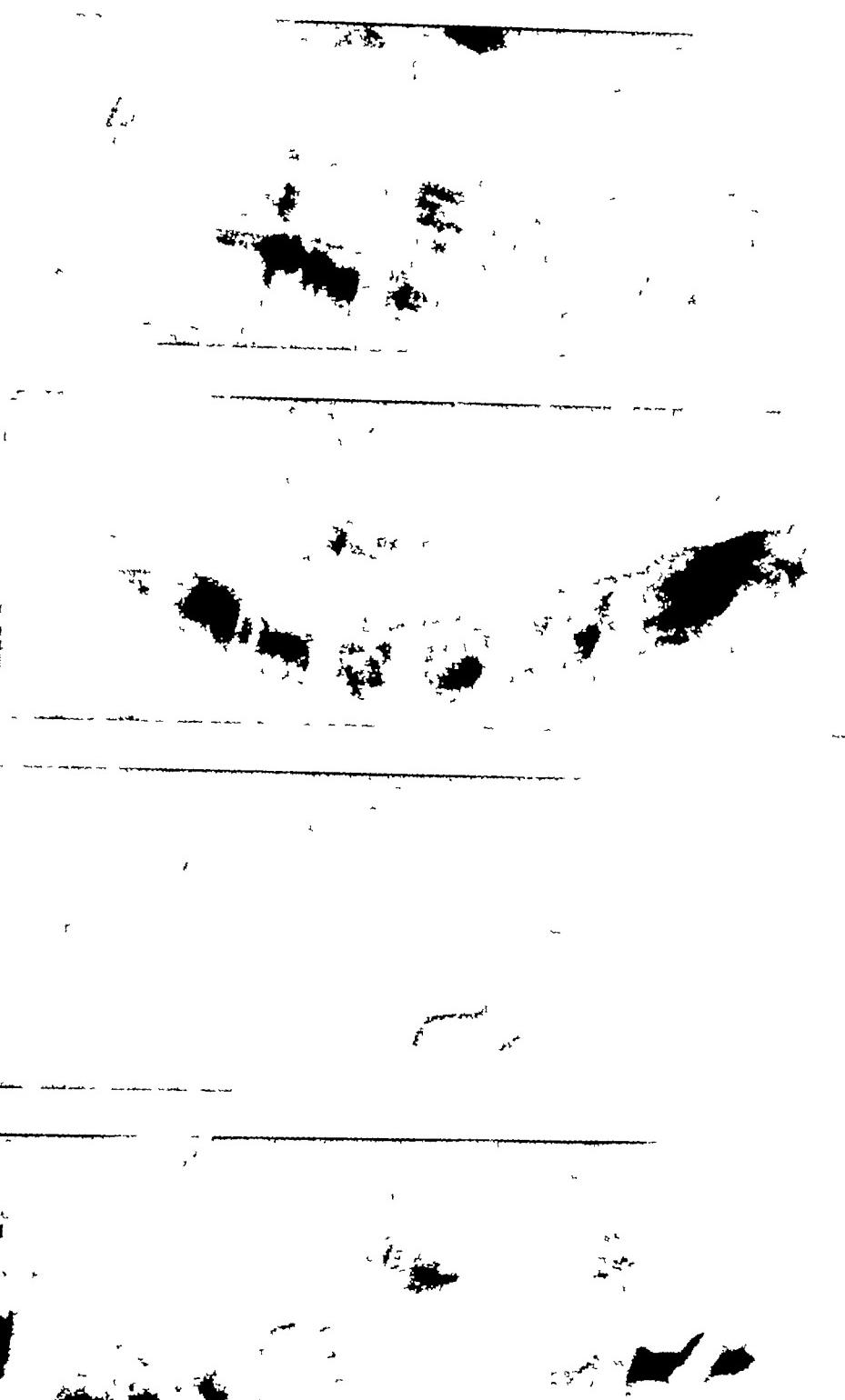


Fig 132 Two of a series of roentgenograms which show obstruction of the peristaltic contractions by an area of non-malignant induration around a benign ulcer (*U*) on the lesser curvature side of the corpus of the stomach

Fig. 130 Roentgenograms made in the oblique direction with the patient in the recumbent (*A* and *B*) and erect (*C* and *D*) postures show unusually active and vigorous peristalsis of the esophagus secondary to a spasm of the diaphragm at the level of the diastrum. The absence of malignant infiltration is shown by the pliability of the wall to the peristaltic contractions. Diagnosis confirmed by esophagoscopy.



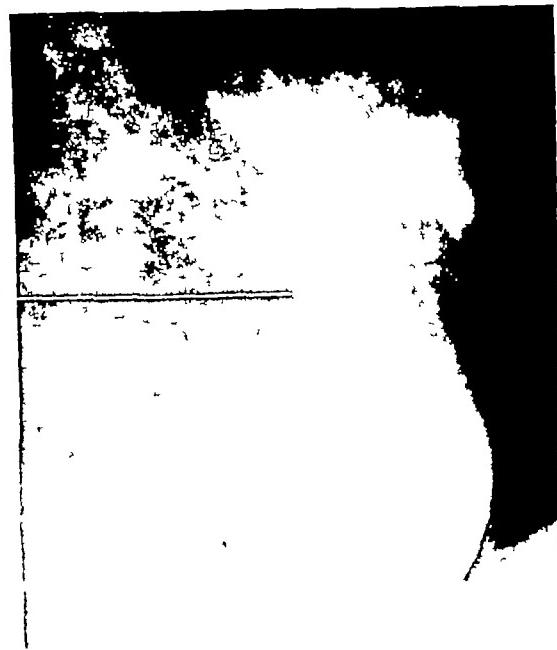


Fig. 131 Two of a series of roentgenograms which show obstruction of the peristaltic contractions by an area of malignant infiltration in the upper part of the corpus of the stomach. There is an ulcerated area (U) in the surface of the new growth

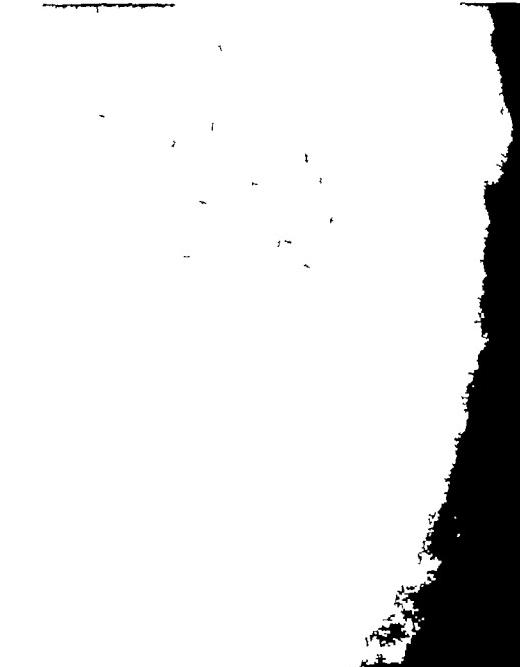


Fig. 132 Two of a series of roentgenograms which show obstruction of the peristaltic contractions by an area of non-malignant induration around a benign ulcer (U) on the lesser curvature side of the corpus of the stomach



Fig. 133 Roentgenogram which was made with three exposures in rapid succession. Each exposure was one-third the duration of the normal exposure. This is a simple method of determining whether or not the gastric wall is pliable to the peristaltic contractions

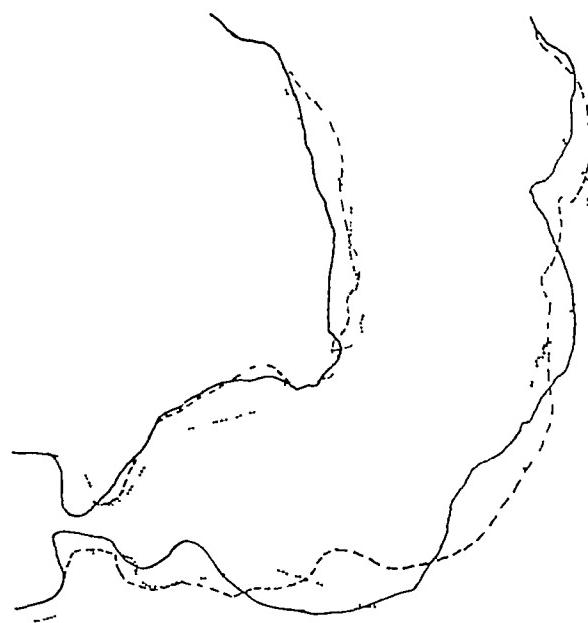


Fig. 134 Roentgenograms of three phases of the gastric cycle which show an extremely small area of lack of peristalsis on the lesser curvature due to an early carcinoma. The area in the diagram in which all three lines coincide indicates the area of lack of peristalsis. This finding might be due to either the scar of an ulcer or an early malignancy.



Fig. 135. A series of roentgenograms which show a very early carcinoma (C) involving the lesser curvature side of the pyloric canal. In this local region there is an absence of the concentric contraction and ex-tracts from its limited degree of expansion in a normal manner. This is the case which Ewing sta-

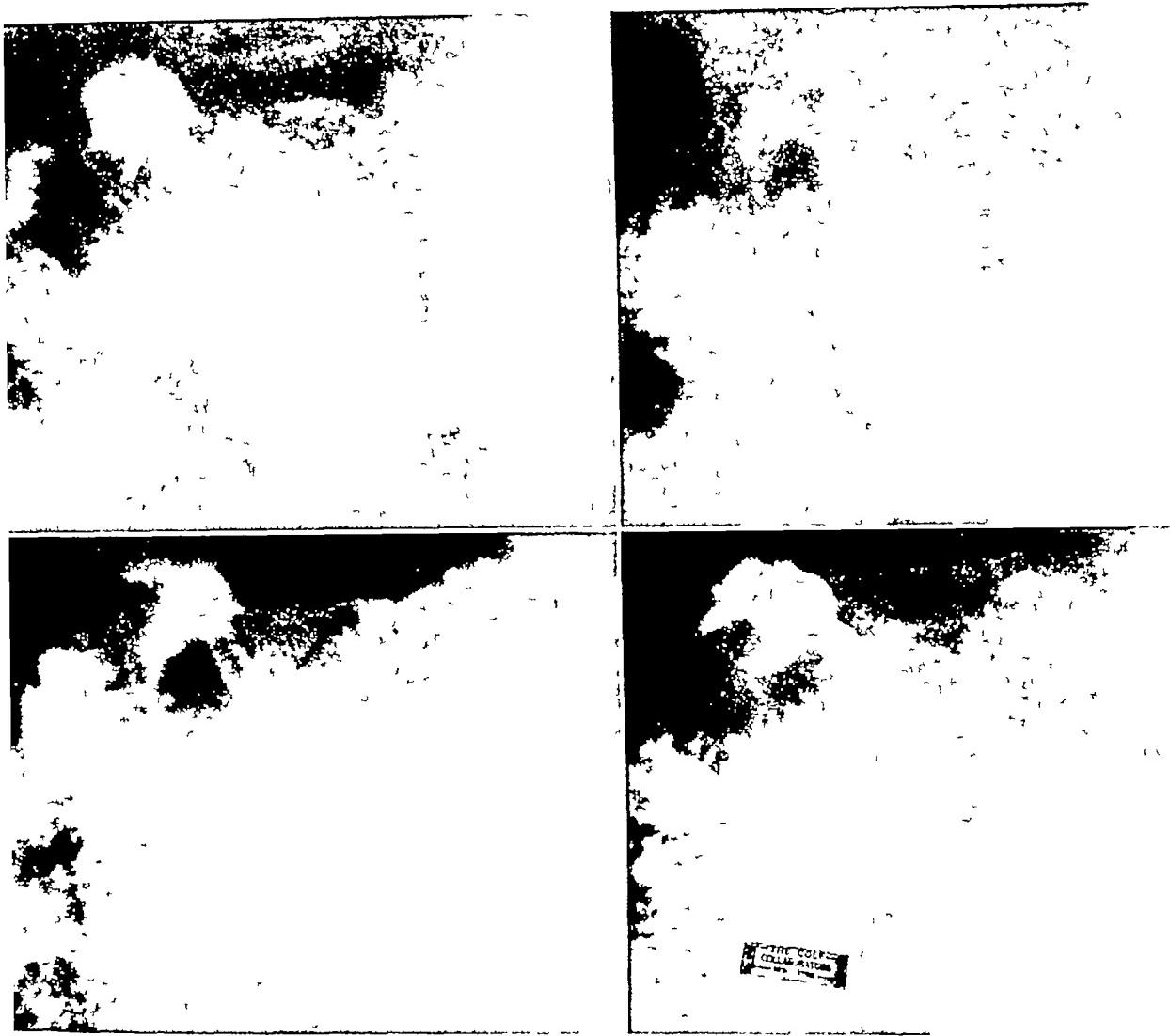


Fig 136 Four of a series of roentgenograms made in the prone oblique posture which show a chronic spasm of the pyloric canal. This lesion is differentiated from malignant infiltration by the fact that the concentric contraction and expansion of the pyloric canal are not entirely destroyed, and by the presence of the normal longitudinal mucosal folds.

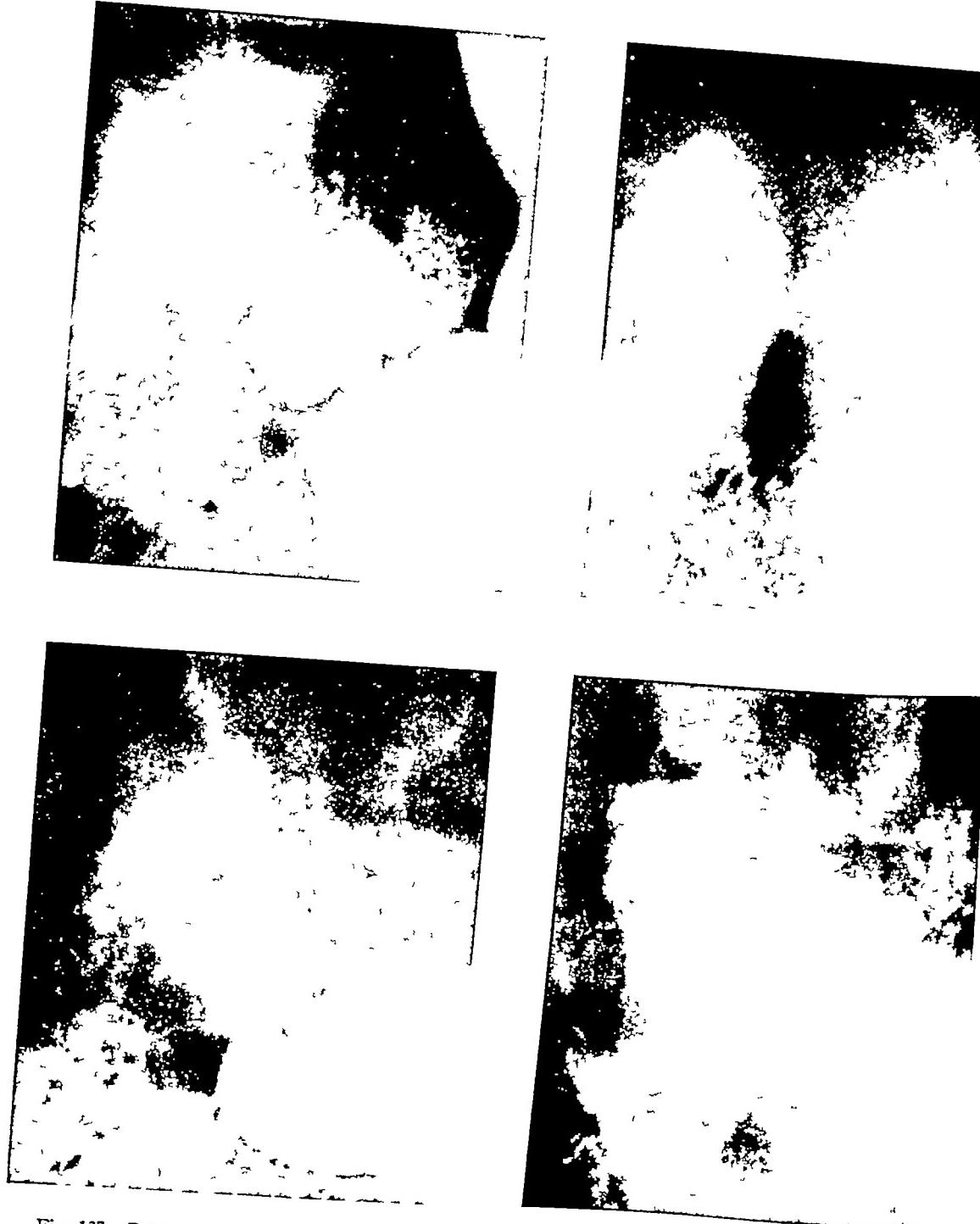


Fig. 137 Roentgenograms of four cases which show the cap being evacuated by a broad wave of peristalsis. The wave begins about the middle of the cap and carries the chyme from the top of the cap rapidly into the descending duodenum

The case illustrated in Figure 135 entered the Fifth Avenue Hospital, New York, with a previous X-ray examination and a positive diagnosis by some other roentgenologist of gastric ulcer. A series of films were made, and the case was up for conference. The clinical history, course of the disease, and physical examination indicated gastric ulcer. This case proved to be of such great significance that we are inserting here a copy of our entire roentgenological report, *verbatim*.

A serial roentgen examination made of the gastro-intestinal tract immediately and six hours after the ingestion of a barium meal shows the size, shape, and position of the stomach and the emptying time of the stomach.

Stomach—Type orthotonic, deformed. Peristalsis three- and four-cycle type, obstructed at the pyloric end of the lesser curvature. Systole and diastole shown very distinctly. Pars pylorica there is an area of induration on the lesser curvature about the size of an English walnut which involves only the lesser curvature, the greater curvature being pliable. This is constant throughout the entire series of roentgenograms. Prepyloric fold not shown. Sphincter slightly eccentric in position.

Cap—Symmetrical in contour and not deformed.

At two hours the stomach is about three-fourths empty.

At six hours there is only a trace of the meal in the stomach and the head of the column is in the cecum.

Diagnosis—There is an area of induration on the lesser curvature of the pyloric end of the stomach about the size of an English walnut which involves only the lesser curvature, the greater curvature being pliable. This is constant throughout the entire series of plates. This does not have all the characteristics of malignancy, but considering its size, location, and the age of the man I believe that the weight of evidence is in favor of its being malignant, and, considering that we always make a negative or positive diagnosis of malignancy, I should feel compelled to make a positive diagnosis of this being malignant.

I believe that one is justified in making a negative diagnosis of ulcer of the cap and postpyloric ulcer. I find no evidence of gallstones or a dilated or pathological gall bladder, but one is not justified in making a negative diagnosis of this condition solely on the roentgenological findings.

The patient was operated on and the specimen was photographed and taken to Dr Ewing within two or three hours after its removal without its having been fixed or cut. After examining the freshly removed gross specimen and having cut it and palpated the surfaces, Ewing expressed the opinion that it was a normal stomach and that I had probably had the man's stomach removed when there was no lesion present. He added—largely to make me feel better—that the microscopic examination might possibly reveal something different. Two days later he called me up on the telephone with great enthusiasm and said that the lesion was malignant, and that he had waited for forty years to see a gastric carcinoma in as early a stage as this. A few days later he sent me the following communication:

DEPARTMENT OF PATHOLOGY, CORNELL UNIVERSITY MEDICAL COLLEGE

Report on Gastric Carcinoma

The material received consists of the pyloric portion of the stomach 11 cm long and 15 cm in diameter at its widest part. Surrounding the pyloric orifice

of 6 cm there is a slight tumefaction of the mucosa, which on the surface is slightly nodular in diameter, where the mucosa is fixed to the muscularis and slightly eroded. The whole area is soft and lacks the usual induration of carcinoma. On section of the eroded area it is found that the mucosa or the thick opaque layer is 3 or 4 mm deep and is fused with the muscularis. This condition extends over a zone 4 cm wide. The serosa is normal, but the surrounding fat tissue is slightly adherent. After fixation in formalin the entire involved area, 6 cm, becomes boardlike, while the rest of the stomach remains elastic. The remaining mucosa shows a marked granular surface, indicating advanced atrophic gastritis. Just beyond the involved area, is a small polypoid projection 4 mm wide, 2 mm deep, which is the seat of the carcinoma.

Microscopic Examination.—The stomach is the seat of an infiltrating adenocarcinoma, which extends through the entire wall, splitting up the muscle fibers over a wide area, reaching the peritoneum and involving the blood vessels and nerve trunks. The main structure is simple tubular glands of various sizes, but there are numerous areas diffusely infiltrated by single tumor cells. There are numerous new lymph follicles. The ulceration is very superficial. The process arises in the tubular glands of an atrophic gastritis and these glands show various stages of transformation from simple atrophy to carcinoma.

Sections taken from the stomach wall, 11 cm from the pylorus, show well marked chronic interstitial gastritis with much overgrowth of lymphoid tissue and considerable fibrosis.

Sections taken 7 cm from the pylorus on the edge of the boardy area show diffuse infiltration of submucosa by cancer cells. This infiltration, although very scanty, accounts for the induration and restricted mobility observed in this segment. The mucosa in this zone shows very marked chronic interstitial gastritis with numerous groups of markedly atypical glands which show many stages toward, but do not reach, adenocarcinoma. These glands show how the original tumor began. It is interesting to note that these changes are identical with the ones found on the edges of old ulcers and are commonly interpreted as cancerous transformation of the ulcer.

Epicritical.—This case represents one of the earliest gastric cancers that I have seen, and one of the earliest that was ever encountered. It is particularly important in that it shows the development of carcinoma on diffuse chronic interstitial gastritis. The superficial erosion is characteristic of a large group of pyloric cancers which seem to develop in the same manner. The very wide infiltration of the submucosa also explains why in many of these cases the infiltration becomes almost universal throughout the stomach, but ulceration is very limited.

[Signed] JAMES EWING, M.D.

Cap.—The cap is evacuated by a broad peristaltic wave which begins about the middle of the cap (Fig. 137) and carries the chyme rapidly from the top of the cap into the descending duodenum and frequently through into the distal part of the duodenum or the upper part of the mesenteric small intestine. During and immediately following the partial emptying of the cap the craters of small ulcers of the cap are often rendered visible, although they had been concealed when the cap was full. The characteristic appearance of this broad wave of peristalsis is destroyed by cicatricial deformity of the cap.

Small Intestine.—The passage of chyme through the small intestine is ac-

complished by broad waves of peristalsis similar to the broad wave which empties the cap and carries chyme into the duodenum. The usual roentgenologic examination records only the fact that the barium meal passes in a normal or abnormal manner through the small intestine. In any roentgenogram made of the small intestine filled with barium, many of these broad waves of contraction may be observed. In cases in which one suspects a lesion in a local region of the small intestine it is very simple to determine by means of serial roentgenography whether or not the wall of the gut is pliable. Fortunately, organic lesions of the small intestine are quite rare and routinely one does not study the small intestine roentgenographically as closely as is really necessary to detect lesions which are not obstructive.

Colon.—Peristalsis in the colon is present as the long waves of contraction, which start from a definite ring of tonic contraction and progressively extend over a long section of the colon and cause mass movements of the contents of the colon. During the passage of the barium meal these extensive contractions are infrequent in occurrence and their detection is more a matter of accident than intent. When the colon is filled with a barium enema, mass movement is likely to occur quite frequently, particularly if the colon is still under the influence of a stimulating cathartic such as castor oil. Progress of the contraction is extremely rapid. The ability of the wall of the colon to contract establishes the absence of infiltration of the muscularis propria.

THE NATIONAL INSTITUTE OF HEALTH¹

By HON JOSEPH E. RANSDELL, WASHINGTON, D. C.,
Former Senator from the State of Louisiana

RADIOLOGY is the youngest of the sciences devoted to the study of physical man, being scarcely more than a third of a century old. Its accomplishments have been marvelous, and there is general belief that the surface of its potentialities for preventing and curing the diseases of human beings has been barely scratched.

While neither a doctor nor a scientist, I have been intensely interested in health problems for twenty-five years, and as Executive Director of the Conference Board of the National Institute of Health I am devoting all my energies to the Institute—the Nation's research center in matters relating to public health.

The bill creating the Institute was first introduced in the Senate on July 1, 1926, but it met with discouraging indifference on the part of most of my colleagues and failed of passage. Believing that persistence is the only cure for such a malady, I again introduced the bill on Dec 9, 1927. It fared a little better on this occasion, and passed the Senate, but was caught in a jam in the House and was killed by the termination of the session. In May, 1928, it was presented to Congress for the third time, and finally, on May 21, 1930, two years to the day after its third introduction, it received the approval of our legislative branch of government. President Hoover wrote the final chapter of this long story by signing the bill on the 26th of that month, and the National Institute of Health became a glorious reality.

During the four years of persistent effort following my first introduction of this measure many men of vision and love of their fellows assisted materially in making it un-

derstood by Congress and the country. This is especially true of the doctors, chemists, dentists, and other scientists who worked actively for the passage of the bill and secured resolutions indorsing it from their great national associations, thereby focusing the attention of Congress upon it. While a few Members of both Houses saw the exceptional merits of the measure and became crusaders under its banner, it was not until Senators and Representatives generally began to hear the voices of their constituents appealing for it that they gave it their support.

It is impossible to name all advocates of the bill, but I can not refrain from mentioning President Hoover, former President Coolidge, Secretary of the Treasury Andrew W. Mellon, and Francis P. Garvan, President of the Chemical Foundation (Inc.). These four great Americans saw with clear eyes the possibilities of the National Institute of Health for preventing and curing disease with its awful train of suffering and colossal economic losses to the world. Without their powerful help this dream of mine could never have come true. They and many others—especially doctors, chemists, and dentists—gave their whole-hearted support to the measure, and I wish to express my lasting appreciation to them.

I can not say too much of the splendid co-operation of the Chemical Foundation, through its wise and generous President, Mr. Garvan, who is so favorably known to radiologists. He gave unceasing and effective aid to the bill in its legislative journey of four years through Congress, and made the first gift to the Institute of \$100,000. I sincerely hope his example will shine brightly and be the guide for many Americans.

Societies such as yours are offered in

¹Presented before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis, Nov. 30-Dec. 4, 1931.

ideal opportunity to co-operate with others in close union with the National Institute of Health under the terms of the act creating it It stands ready to receive your aid in its search for solution of many unconquered diseases, which are still a curse to civilization The Public Health Service, of which the National Institute of Health is a part, points to its wonderful record of the past and invites you to partake of the sacrifices and the glory which are the lot of scientific research workers in the cause of health I trust you will join hands with this splendid agency and assist in giving to the world some measure of the true happiness which comes from good health

While research activities in science have resulted in commendable reduction of mortality and alleviation of suffering we have not kept pace with the times in matters of public health conservation It is a sad commentary on the agencies dealing with health that influenza and pneumonia are as deadly to-day as they were a hundred years ago, that cancer and heart affections are claiming greater tolls in lives each year, and that the population of our institutions for the mentally deficient is increasing at an alarming rate Dr Charles W Mayo, in a recent speech before the Annual Clinical Congress of the American College of Surgeons, said "The world has moved ahead so fast as regards material civilization that man has almost for the moment got behind in his power of adaptation Every other hospital bed in the United States is for mentally afflicted, insane, idiotic, feeble-minded, or senile persons"

It is only fair to say, however, that our lagging in the matter of health research has not been due to the inefficient mentality of our scientists, but to the woeful lack of facilities and the discouraging insufficiency of funds to stimulate recruits in science The crying need of the American scientist engaged in a study of health problems is a

great laboratory fully equipped to cope with every disease where he can carry on his work in close co-operation with other students of the laws of life, and with every possible facility at his disposal

Provision was made for supplying that need by my bill creating the National Institute of Health, which contains three distinct features

First It creates the Institute in the United States Public Health Service, under the administrative direction and control of the Surgeon General, for the special purpose of scientific research to ascertain the cause, prevention, and cure of diseases affecting human beings It does not establish any new bureaus or commissions but utilizes existing Government machinery, provides for enlargement of the former Hygienic Laboratory, which came into existence in 1901 by congressional action, and appropriates \$750,000 for the erection of additional buildings

Second It authorizes the Secretary of the Treasury to accept gifts for study, investigation, and research in problems relating to the health of man and matters pertaining thereto, with the provision that if gifts in the sum of half a million dollars or more are made, the name of the donor shall be perpetuated in a suitable way This feature of the act is most unusual and important No precedent can be recalled of donations from philanthropists to enable the Federal Government to maintain institutions for the purpose of research, with possibly two exceptions—the Smithsonian Institution and the Library of Congress The Smithsonian was founded on the gift of \$550,000 by James Smithson to disseminate knowledge among men It stands as a monument to his name and its achievements are known throughout the world The authorization granted to the Library of Congress to accept funds for special purposes has resulted in gifts to it exceeding \$2,600,000

Third It proposes the establishment and maintenance in the Institute, out of funds donated for that purpose, of a system of fellowships in scientific research to encourage and aid men and women of marked proficiency to combat the diseases that menace human health. This provision of the act is regarded as its outstanding feature, for these fellowships offer an opportunity to those specially qualified to serve their fellow-men in the most useful of all ways. While it is contemplated that the bulk of research work will be carried on in the Institute laboratories in Washington, it is not so limited. Under the terms of the act these fellows can be assigned to institutions in any part of the globe, wherever the research problem may be undertaken most advantageously.

This Institute marks the beginning of a new chapter in the history of medicine of a most far-reaching influence in the relief of human suffering. The act creating the Institute is a veritable declaration of war against all the physical forces detrimental to health on a greater scale than ever before attempted. It centers in the Nation's capital all the country's medical and scientific resources for combating disease and creates in Washington a clearing house of health for all the world.

Under a commander-in-chief—the Surgeon General of the United States Public Health Service, with the director of the Institute as his first lieutenant in active charge—will be marshaled the Nation's army of experts in the sciences of medicine, surgery, psychiatry, dentistry, chemistry, physics, radiology, biology, bacteriology, pharmacology, pharmacy, and allied professions in a concentrated drive to prevent disease by ascertaining its cause and applying preventive measures in advance of its outbreak.

In the national capital has been founded an institution devoted solely to study, investigation, and research in problems relating

to the health of man, where every available facility will be provided to aid and encourage scientists to combat sickness and solve the many remaining mysteries of disease, and where all knowledge and every advance in the promotion of human health will be pooled and correlated.

The plan of the Institute is to make of it an immense co-operative scientific organization, in which leading experts in every branch of science connected with plant and animal life will be brought together and given opportunity to work in unison for the purpose of discovering all the laws of life. Harmonious co-operation—one for all and all for one—is the watchword of the Institute.

In this Institute will be carried on new researches in cancer on a greater scale than ever before attempted, new investigations into the cause and cure of infantile paralysis and heart diseases, new studies of the common cold, influenza, and pneumonia, here will be made new discoveries, new and better methods of cure and treatment will be found to replace those now in use, and new and greater safeguards of health in general will be devised.

Although truly remarkable advances have been made in the war for health by individual scientists, by private and governmental institutions, no agency has ever been founded on earth for combating disease on so comprehensive and co-operative a scale as the National Institute of Health. While it is impossible to predict its eventual benefits to humanity, they are certain to be very great.

Genuine co-operation in science is necessary if the best possible results are to be obtained. Dr Treat Johnson, of Yale, said "Nothing can be done, no attack can be made on any (health) problem, except through the principle of co-operation. No one to-day can cover any single field in

science individually and make progress. He must work in co-operation with others.

Until this Institute was created there was no place in which radiologists could meet their brother workers in other branches of science in order to formulate better means of preventing and eradicating disease. Dr. Julius Siegitz of the University of Chicago, deplored the lack of peace-time co-operation among scientists in the field of health, pointing out that in time of national danger from war a great mobilization of scientists takes place in order to bring into existence destructive forces with which to fight the battles of men. In 1923 he said: "There is no institution in which the chemists of the United States can come together with the medical scientists to inaugurate a general attack upon the forces that kill. . . Let there be another war, and no doubt the chemists will be mobilized again, but they will be mobilized to kill."

The National Institute of Health furnishes the means by which can best be put into practice the 'principle of co-operation' described by Johnson as being so essential to the success of the research expert. It is the agency which Siegitz had in mind—an institution where radiologists and chemists can work in friendly union with every other branch of science to solve health problems giving the benefit of their vast store of knowledge in alleviating pain and preventing sickness.

This act provides radiology with the opportunity to render a priceless service to humanity. The Institute enables it to bring into close co-operative effort with other sciences its research activities in a field that includes one of the most difficult and desultory of all unconquered diseases—cancer. Radiologists are devoting much time and effort to the study of this dread malady, which is causing untold suffering and death. While the span of life has been materially lengthened and the death rate in many diseases steadily reduced, cancer has

not responded to scientific treatment and its mortality rate has increased to alarming proportions. In 1850 approximately 32 people per hundred thousand died with cancer. In 1910 the figure had risen to 73, and in 1929 the fatalities from cancer had reached the appalling total of 115 per hundred thousand. In this great altruistic agency, which our Government has provided, you can bring into play, in connection with other sciences, all your skill and research ability to blot out this and other diseases.

Dr. Joseph Colt Bloodgood, one of America's ablest physicians and strongest believers in the merits of your science, who has devoted his great intellect to fighting cancer, and who is with us to-night, recently said: "No specialty in medical science and practice has developed more rapidly than radiology, both in its diagnostic and therapeutic aspects. . . Radiology is not one of the greatest specialties in medicine. We owe a great debt of gratitude to the pioneers, many of whom have lost their lives because of their ignorance of how to protect themselves from irritation of X-ray and radium. . ." May I add that in my opinion no science is destined to play during the next half century a greater part than radiology in the world-wide battle with disease.

The Institute stands surely in need of added facilities with which to carry on its noble work. Only recently Surg. Gen. Hugh S. Cumming, of the United States Public Health Service, said: ". . . Probably the greatest immediate need of the National Institute of Health is the completion of its physical development, especially additional buildings to house a division of physics, where studies, especially of light and ventilation, as they affect the general health of the people, and of the use of X-ray and radium in the treatment of disease, can be undertaken; and a division of physiology, the work of which is intimately concerned with every division of the Institute. Other work which it is desired to take up as soon as

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belongs to the people and is responsible to them Their problems are its problems It provides for continuity Research work should not be taken up and dropped at the whim of some capricious benefactor or changing board of directors It requires years of continuous application to a definite plan which Government conditions supply Again, the checks and control of Government financial methods assure us that money allotted to this work, whether from private donations or appropriations by Congress, will be carefully accounted for and put to good use

The past record of the Public Health Service indicates that it is the agency *par excellence* to lead in this great public-health movement and that Congress acted wisely in confiding to it the entire management and direction of the National Institute of Health The service now has a large corps of trained personnel engaged in scientific investigations in many parts of the country, which can be most effectively used as a nucleus for developing the necessary organization to undertake the proposed researches in the Institute

Not only does the Public Health Service have in its ranks many experienced and scientific workers but it also has laboratory and other equipment that is being used to great advantage in research work I can not say too much about the work of the United States Public Health Service, which for many years has aided the States in times of epidemic, has made exhaustive studies in health conditions, and, in general, has been a most important factor in reducing mortality in this country

In conclusion, let me appeal to you and to all radiologists to devote your vigorous young intellects to the alleviation of human suffering Your science can be of invaluable assistance to the National Institute of Health in making of it a truly great research institution, thereby fulfilling its noble destiny Good health is the most precious of earthly blessings Nothing can take its place With it, one can enjoy life amid great hardships Without it, vast wealth can not bring happiness To attain this great blessing we should strive so earnestly that when our earthly careers are about to close each and every one can say in the language of the immortal Pasteur, "I have done what I could "

Would Investigate Effects of Radium Find on Evolution—Do the great deposits of radium ore recently discovered in northern Canada have any effects in speeding up the rate of evolution of the plants and animals in their neighborhood?

This question has been raised by Prof W C Broadfoot, of the University of Alberta, who calls attention to the now well-

known ability of X-rays to speed up evolutionary change, first demonstrated to the scientific world by Prof H J Muller, of the University of Texas The effects of radiations from radium and other radio-active substances have also been the subject of numerous experiments, and of observations on living organisms in regions of high natural radioactivity in the earth—*Science Service*

funds and facilities are available are studies of arthritis, focal infections and their relation to chronic degenerative diseases, degenerative diseases of the arterial system, the common cold, puerperal fever, life cycles of bacteria, etc."

The 1931 report of the Twentieth Century Fund (Inc.), entitled "American Foundations and Their Fields," states "Judged by the amount of money donated in 1930 (by 21 leading American foundations, exclusive of private benefactions) the field of medicine and public health is the most popular, a total of \$18,627,222 in grants to it having been reported in the returns. More than one-third (35.5 per cent) of all funds given away by the foundations canvassed has gone into this field."

Of this liberal sum, \$8,396,932, or 45.1 per cent, was paid in support of educational activities, \$8,401,825, or 45.2 per cent, in support of social action, and only \$1,828,-458, or 9.7 per cent, in support of research.

This is very striking, and shows that while American philanthropists, as represented by the report quoted above, were quite generous last year in support of medicine and public health in a general way, less than 10 per cent of these sums were given to pure research, without which it is impossible to ascertain the cause and cure of disease. It is unfortunate that so little was donated last year by these 21 foundations to health research, but I have no doubt that individual benefactions for that purpose were considerable.

Recently an article appeared in "Nation's Business," entitled, "My Money after I Die—by a Man who has Some." The author expressed an earnest desire to so dispose of his large wealth as to promote human happiness and make it continuously useful. Beyond question, suffering, sickness, and death will last until the end of time, and there is no surer way to make money continuously useful in promoting health and happiness

than by liberally endowing the National Institute of Health.

Although the name and some of the facilities are new, the National Institute of Health has been a going concern for over 30 years, and has 155 persons hard at work every day on some phase of health investigation. It has been of tremendous aid to research in the world, and it is impossible to enumerate here even briefly the total of its accomplishments and contributions to science, yet a few points can be noted in connection with past and present work.

From the Institute have come Dr Goldberger's monumental work in the discovery of the cause and prevention of pellagra, Dr Francis's work on tularemia, Dr Spencer's work on spotted fever and his discovery of a protective vaccine, the discoveries of Dr Dyer, Dr Rumerich, and Dr Badger of an Eastern form of spotted fever, which may prove to be one of the most important public health problems, Prof Voegtlín's fundamental work in the metabolism of normal and cancer cells, and Prof Hudson's contributions to work on the chemical structure of sugars.

At the present time, under the guidance of its director, Dr G. W. McCoy, studies are in progress at the Institute relating to nutrition, cancer, typhus-spotted fever, tularemia, infantile paralysis, undulant fever, spinal meningitis, ginger paralysis, standardization of certain drugs, fundamental researches on sugar, and many other problems. Lastly, through its work in the control and standardization of biologic products, the Institute has rendered a very great service to the people of the United States in safeguarding the numerous serums and vaccines placed on the market, and a number of the biological standards worked out at the Institute have been adopted by many foreign countries.

The advantages of having such an institution in the Government are apparent. It

belongs to the people and is responsible to them Their problems are its problems It provides for continuity Research work should not be taken up and dropped at the whim of some capricious benefactor or changing board of directors It requires years of continuous application to a definite plan which Government conditions supply Again, the checks and control of Government financial methods assure us that money allotted to this work, whether from private donations or appropriations by Congress, will be carefully accounted for and put to good use

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TEACHING OF RADIOLOGY TO UNDERGRADUATE STUDENTS¹

By HENRY K. PANCOAST, M.D., PHILADELPHIA

From the Radiological Clinic of the Medical School of the University of Pennsylvania and the University Hospital, Philadelphia

RADIOLOGY occupies rather a unique position as a subject for teaching to undergraduate medical students. It is a new medical specialty. Its diagnostic and therapeutic applications have grown at a tremendous rate and have become unusually widespread. While it is more or less intimately concerned in every branch of medicine, its development has been left largely in the hands of a comparatively few medical men, assisted in a great measure by physicists and manufacturers of equipment. Its development and its position as a specialty have been taken largely for granted by the greater part of the medical profession. Comparatively few students or recent graduates expect to take it up as a specialty or even to practise it directly in a smaller way, although it must serve all of them. For these reasons, little earnest thought has been given to radiology from the standpoint of undergraduate teaching, aside from the desire and pride on the part of radiologists to further the interests of their specialty. The latter attitude is but natural, for, as Barclay² states, "when a teacher is placed in charge of a special department, it must be his aim and object to further its interests."

REASONS FOR TEACHING UNDER-GRADUATES RADIOLOGY

While radiologic specialists are constantly urging their claims for teaching privileges, the question frequently arises no doubt in the minds of medical faculties as to why any extended instruction in radiology to undergraduates is necessary. This can be an-

swered by numerous reasons, which, because of their multiplicity and complexity, require enumeration.

1. The intern and the comparatively inexperienced young physician should know something about a means of diagnosis and treatment which either must call on frequently for assistance. Perhaps this appeals to me more than it does to some of the younger generation because my student, intern and early medical experience was gained in the first years of roentgen diagnosis and treatment, when there was no teaching of any kind on the subject. Impressions of roentgenograms and the reasons for therapeutic actions and their effects were as vague as they possibly could be on any subject pertaining to medicine. When, as an intern, I was shown the roentgenogram of a chest, no mental impression whatever was made of the patient's condition because of an utter lack of knowledge of anatomy and pathology as they might be expressed by roentgenographic shadows and appearances. The intern of the present day, however, realizes something of the value of roentgenologic studies because he has been taught something about the subject. He has some understanding of normal and pathologic appearances when they are demonstrated to him. He even learns to interpret abnormalities for himself.

2. To-day one seldom sees a clinical journal that does not contain important references to roentgen diagnosis or therapy. Must the intern or the young physician skip over these references without a proper understanding of them?

3. Roentgen diagnosis now is applicable to every branch or specialty in medicine. In surgery every fracture and dislocation must

¹Read before the Annual Congress on Medical Education, Medical Licensure and Hospitals, Chicago, Feb. 16, 1932. Reprinted by permission from the *Journal of the American Medical Association*, March 19, 1932, NCVIII, 938.

²A. E. Barclay, *The Dangers of Specialization in Medicine* (the thirteenth Sylvanus Thompson Memorial Lecture) *British Jour. Radiol.*, February 1931 IV 60-82.

xamined, not only because of the aid to the surgeon and patient but also of almost a legal requirement. The genogram is the most satisfactory and means of diagnosing and studying diseases and tumors in most instances by all surgical gastro-intestinal lesions diagnosed or confirmed by roentgeno-study. The detection or confirmation large number of urologic conditions depends on roentgenologic assistance, often by intravenous or retrograde urography. Diseases of the gall bladder, intrathoracic lesions, many intrathoracic conditions and a host of others require study by method. In connection with internal medicine the radiologist has to search for of infection in the teeth and sinuses practically all intrathoracic conditions receive more or less roentgenologic study. The digestive tract and the gall bladder constitute a wide field for investigation. In addition, there are bone, joint, soft tissue and many other conditions for which examinations frequently must be made. The pediatrician frequently calls for assistance in examinations of the sinuses, mastoids, larynx, chest, and bones. The orthopedist could be lost without roentgenologic aid. The bronchoscopist could do but little without it. The laryngologist requires it constantly, and the neurologist very frequently uses radiology as practically a specialty among his specialties.

6 The student should be taught the value and in many instances the absolute necessity for, roentgenologic diagnosis as well as limitations, for he is soon to become an intern. As such, he is in many instances likely to request roentgen examinations, until, perhaps, the radiologist has reason to distrust his judgment and insists on a higher authority.

7 The student of to-day should be taught to depend on roentgenologic aid at the expense of other and older diagnostic meth-

ods. He must learn to realize that such studies are expensive procedures for patients and institutions and should not be employed unnecessarily. On one occasion, an intern requested studies on a single patient in a ward which would have cost the institution over seventy dollars had they been carried out. A large part of this general examination was found to be entirely unnecessary.

6 There is a tremendous amount of mediocre roentgenologic work being done to-day by untrained and inexperienced men, and much of it is practically valueless and even misleading. The student and, later, the intern should be taught to realize this, so that when they enter into practice they may be able to judge what is dependable and what is not. Nevertheless, one should not be too hasty in judgment of diagnostic ability on the basis of the appearance of roentgenograms, for they may have been made under unusual and difficult circumstances beyond control if poor, or, on the other hand, some men can produce excellent technical results without having the ability of correct interpretation.

7 To establish the fitness of the young practitioner for such judgment and understanding as have been specified requires that instruction of some kind should have been instituted during his student days, whereby he could have gained some knowledge of normal roentgenographic appearances, their variations within normal limits, and the modifications produced by pathologic processes. By the time of his graduation and the beginning of his internship he should be able to understand the principles of interpretation of living pathologic conditions in roentgenologic terms. The internship would then be the time for him to gain what is needed in the way of experience.

8 Roentgenology is largely but not entirely in the hands of the medical profession to-day. Whether it will eventually fall more and more into the hands of commer-

cial enterprises outside of institutions depends almost entirely on the proper teaching of the younger members of the profession of the interrelation of radiology with the other branches or specialties of medicine. There is a growing tendency, apparently the world over, in the direction of commercialism, even with the vicious habit of fee-splitting. Lack of oversight in this particular line of work only serves to encourage similar proclivities in others. Haenisch,³ of Hamburg, in a recent memorial address, when commenting on the misfortunes arising from the rapid expansion of radiology when it lacked the co-operation of other specialties, made the following statement:

"The harm, however, which resulted from a too rapid expansion of the art and the consequent faulty, insufficiently prepared training was not the worst. This could, if the will were present, be minimized or even eliminated. Much more disastrous was the fact that the incompetent and dishonest elements grasped this specialty. These, in some instances, were unscrupulous physicians who were guided merely by the expected pecuniary advantages and who, unhampered by clinical and roentgenological knowledge and experience, 'sold X-ray pictures,' paying the referring physician rebates or commissions.

In other instances laymen, with or without connivance of dishonest physicians, saw in the purchase of X-ray apparatus a get-rich-quick scheme at the expense of innocent patients."

These practices are all too common, and their elimination must be a co-operative process, and the warning and the education cannot come too early.

9 Radiation therapy has a large share of importance in the treatment of neoplastic disease and many other pathologic conditions. To-day, operative surgery, electro-thermic procedures, and the use of roentgen

rays and radium are the only approved methods of dealing with cancer, which is one of the most important conditions with which we have to deal in these modern medical times, because it is second in mortality rate among adult diseases. The greatest efforts are being made by interested medical bodies to teach the public and, still more important, the medical profession, the importance of early diagnosis and proper treatment. It is generally agreed by these bodies that the proper time to begin this instruction is in the undergraduate medical schools. The teaching is preferably to be carried out by cancer clinic groups, but in lieu of this it must emanate largely from the surgical, medical, and radiologic groups. Many of the unethical and unscientific methods of treating cancer could not flourish to the extent to which they do to-day did they not receive encouragement from men who have not been properly taught. Irradiation is a part of the therapeutic armamentarium of the dermatologist, and the student should be able to understand why it is used on the basis of biologic effects.

10 The dangers from excessive X-ray exposure should be understood, especially as they may be experienced in roentgenography and fluoroscopy for various purposes. Radiologists are frequently embarrassed by the lack of knowledge of these dangers on the part of the medical profession in general.

METHODS OF TEACHING

The reasons so far enumerated would seem to constitute ample justification for instruction in radiology during the undergraduate and intern periods. The latter is an ideal opportunity, but this aspect of the teaching problem will not be considered here. Fortunately, intern instruction is prescribed by medical boards in many States. My only suggestion in this connection is an insistence that the groundwork should begin during

³G F Haenisch, Roentgenology as a Specialty (the Caldwell Lecture), Am Jour Roentgenol and Rad Ther December, 1931, XXVI, 821-833

the undergraduate period. The next arguments are over the time, the place, and the method. Barclay states "It is quite true that the overburdening and consequent extension of the medical curriculum is due to the increase in specialization. The student of to-day has a far greater load of learning to cram into his head than he had a few years back, far more than he can ever hope to remember." The method of general didactic class instruction in radiology as carried out in most institutions in the past has been a failure in many respects. It has certainly not accomplished the desired results, and the only service it fulfils is to give the class as a whole some idea of the scope of radiology, and this is not sufficient compensation for the time and effort. Didactic teaching by lectures to hitherto untaught students means in part the showing of series after series of roentgenograms or lantern slides representing pathologic conditions which the student sees with little or no understanding of their import. Even were he shown the normal first, he cannot correlate that appearance with the structures of the human body represented because he has never been taught to do so. The futility is realized when the teacher reads examination papers or asks even the most practical questions at the end of the period. A few exceptional students may have grasped the subject, but the large majority have not. Didactic lectures are better adapted to graduate students who have received sufficient groundwork in the subject to enable them to absorb and assimilate that kind of instruction. Didactic teaching of radiology had its inception largely in the fact that no text-books were procurable on the subject, whereas this method has gradually declined in other specialties as suitable collateral text-books have become available.

Human psychology requires that the reasons for certain results must be explained if these results are to be understood and are to make any permanent impressions on mem-

ory. Hence, if the student knows why and how roentgenographic and fluoroscopic appearances are brought about or biologic effects are produced, his mind will be more receptive in the way of interpretation of shadows of the body structures and the indications for treatment by irradiation and the results obtained thereby. Therefore, in teaching radiology it is necessary to preface the practical aspect of the subject by a short course of instruction in physics. This must be didactic, but it should be made as elementary as possible and, at the same time, interesting. It should have been taught as a pre-medical subject, but this seems seldom to have been done, or, at least, not in a manner capable of impressing the students in a way a teacher of radiology would desire. The most appropriate time for it, or, at least, to review the necessary part of the subject of physics, if it must be included in the undergraduate medical curriculum, would seem to be during the first year. Then there is more time for it and it can precede any practical teaching. Surely the medical practitioner should know something about the physics pertaining to X-rays and radium and the physical problems involved in their application. It need be but a small percentage of what the radiologist must know and even make use of every day. The physician should be able to talk intelligently with his patients about what he orders for them, if nothing more. How many physicians know just why irradiation is used in cancer or the difference between radium and its emanation or the similarity in effects of roentgen rays and radium? The utter lack of knowledge by physicians of the most elementary facts concerning radiology is often ludicrous and, at times, even embarrassing to the radiologist. Their utter ignorance of nomenclature is all too apparent to editors of journals. The teaching of all the physics a student requires should take but a few hours.

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cial enterprises outside of institutions depends almost entirely on the proper teaching of the younger members of the profession of the interrelation of radiology with the other branches or specialties of medicine. There is a growing tendency, apparently the world over, in the direction of commercialism, even with the vicious habit of fee-splitting. Lack of oversight in this particular line of work only serves to encourage similar proclivities in others. Haenisch,³ of Hamburg, in a recent memorial address, when commenting on the misfortunes arising from the rapid expansion of radiology when it lacked the co-operation of other specialties, made the following statement:

"The harm, however, which resulted from a too rapid expansion of the art and the consequent faulty, insufficiently prepared training was not the worst. This could, if the will were present, be minimized or even eliminated. Much more disastrous was the fact that the incompetent and dishonest elements grasped this specialty. These, in some instances, were unscrupulous physicians who were guided merely by the expected pecuniary advantages and who, unhampered by clinical and roentgenological knowledge and experience, 'sold X-ray pictures,' paying the referring physician rebates or commissions.

In other instances laymen, with or without connivance of dishonest physicians, saw in the purchase of X-ray apparatus a get-rich-quick scheme at the expense of innocent patients."

These practices are all too common, and their elimination must be a co-operative process, and the warning and the education cannot come too early.

9 Radiation therapy has a large share of importance in the treatment of neoplastic disease and many other pathologic conditions. To-day, operative surgery, electro-thermic procedures, and the use of roentgen

rays and radium are the only approved methods of dealing with cancer, which is one of the most important conditions with which we have to deal in these modern medical times, because it is second in mortality rate among adult diseases. The greatest efforts are being made by interested medical bodies to teach the public and, still more important, the medical profession, the importance of early diagnosis and proper treatment. It is generally agreed by these bodies that the proper time to begin this instruction is in the undergraduate medical schools. The teaching is preferably to be carried out by cancer clinic groups, but in lieu of this it must emanate largely from the surgical, medical, and radiologic groups. Many of the unethical and unscientific methods of treating cancer could not flourish to the extent to which they do to-day did they not receive encouragement from men who have not been properly taught. Irradiation is a part of the therapeutic armamentarium of the dermatologist, and the student should be able to understand why it is used on the basis of biologic effects.

10 The dangers from excessive X-ray exposure should be understood, especially as they may be experienced in roentgenography and fluoroscopy for various purposes. Radiologists are frequently embarrassed by the lack of knowledge of these dangers on the part of the medical profession in general.

METHODS OF TEACHING

The reasons so far enumerated would seem to constitute ample justification for instruction in radiology during the undergraduate and intern periods. The latter is an ideal opportunity, but this aspect of the teaching problem will not be considered here. Fortunately, intern instruction is prescribed by medical boards in many States. My only suggestion in this connection is an insistence that the groundwork should begin during

³G. F. Haenisch, Roentgenology as a Specialty (the Caldwell Lecture), Am. Jour. Roentgenol. and Rad. Ther., December 1931, XXVI, 821-833.

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duced by heavy exercise after a meal, mental fatigue and headache, and that most or all of these phenomena can be demonstrated easily by the fluoroscope? Students seldom know the differences in motility of the upper and lower small intestine and of the mass type of peristaltic phenomena of the colon, and yet these are all practical facts. Several men have followed Cannon in this line of investigation, but many have not. During recent studies of the normal swallowing act I have been surprised at the inaccuracies of physiologic statements concerning this mechanism or the lack of them. Barclay⁴ has been struck by similar observations. It is almost inconceivable how the radiologist could have progressed as he has without the help of the physiologist, but it is conceivable that progress could have been more rapid with the physiologist's co-operation in the early days. It is quite easy to demonstrate how coarse foods remain much longer in the stomach than semiliquid suspensions of finer food particles. This is an example of information that would be of value in connection with later clinical teaching. Demonstrations of barium enemas would be most instructive even if made but once to each student. The pulsations of the heart and vessels, the normal movements of the diaphragm domes and the costal movements with respiration would be so spectacular as to be easily remembered by the student. Naturally, all such demonstrations could be witnessed by only small groups of students at a time. The dangers of exposure should be considered carefully as they apply to both observers and subject, and all such demonstrations should be under the direction of the department of radiology.

Pathology is the next branch by which the student should be helped toward an understanding of the practical aspect of roentgenology. Any teaching along this line should follow that of the normal, as already de-

scribed. Pathologic anatomy in conjunction with roentgenology should be taught, first, from the standpoint of the manner in which the disease affects the structure directly and grossly, and, secondly, as it alters function, because roentgenology is essentially a study of pathology in the living subject and thus differs from morbid anatomy as it is usually understood. The student should learn the actual gross and microscopic pathology first and then be taught to apply that knowledge to roentgenographic and even fluoroscopic appearances, just as the trained roentgenologist has to do every time he attempts to interpret evidences of disease in his roentgenograms or by roentgenoscope. The latter didactic course in radiology will serve to show that when two or more pathologic processes present similar or indistinguishable appearances the clinical aspect of the case at hand, that is, history and clinical observations, must be carefully considered in the rendering of a correct interpretation by the process of exclusion. It is probable that, when the student has become familiar with normal roentgenographic appearances, typical roentgenograms of pathologic conditions will serve the pathologist well for demonstration purposes, not only when teaching from gross specimens, but also in general didactic instruction in various pathologic conditions. Needless to say, a normal roentgenogram of the structure should always accompany that of the pathologic condition under discussion, as for example, cancer or ulcer of the stomach, intestinal neoplasms, bone tumors, aneurysms, heart conditions and many other intrathoracic lesions. It would seem almost if not quite as important to teach roentgen appearances in pathology as it is the histologic pictures of the processes. The roentgenograms of the patient should always be on display in the autopsy room, especially when students are present.

PLACE IN CURRICULUM

The question naturally arises as to how

⁴A. E. Barclay. The Normal Mechanism of Swallowing. Proc. Staff Meet., Mayo Clin., Sept. 10, 1930, V, 251-257.
British Jour. Radiol. December 1930, III, 534-546.

all this instruction is to be carried out in connection with the preclinical branches, and especially in a minimum of time in an already overcrowded curriculum. The time factor in the problem may be disposed of first. All the demonstrations mentioned would be of comparatively short duration and form really a part of the teaching of the branch in which they are included. Many of them would lead to a better understanding of the subject at hand, especially from the practical point of view. I believe that the results obtained would amply pay for any extra time consumed.

It would seem preferable for all this pre-clinical as well as subsequent instruction to be under the direction of the professor of radiology, and for the teaching or demonstrations in each branch to be arranged through agreeable co-operation with the professor in each. There could be one fully equipped roentgenologic department in the medical school, with a well trained technician in charge who could handle all demonstrations and also take charge of all experimental work, as in research surgery, physiology, anatomy, pharmacology and other branches requiring it. This technician would not be a teacher. There are two ways in which roentgenologic teaching could be carried out. The first would be directly by a representative of the department of radiology. The radiologic staff in a teaching institution and hospital must, of necessity, in these days, be a large one. There must be a professor at the head and at least one or two associates. The assistants are frequently two-to-three-year fellowship men, who are to become the trained radiologists of the future. They usually have minor faculty appointments. Technicians must look after all the details of purely technical work. One or more of the associates or fellowship men could be appointed to look after all the details of the instruction in the preclinical branches. The other plan would be to place

this instruction in the hands of trained and competent members of the staffs of the branches, but with the department of radiology having a co-operative oversight. A combination of the two plans might be found advantageous. Decentralization of radiology is usually not a successful venture in the long run. It is a duplication of effort and is expensive and is not conducive to the best interests of teaching in general. It leads to a one-track mind, whether applied to anatomy, physiology, or clinical subspecialties, and fails to preserve the active spirit of co-operation so essential to the perfect teaching machine. The trained and experienced general radiologist is in a better position to see how the teaching in connection with all the branches can be best correlated. Clinical radiology is not laboratory work as we usually understand it. The trained radiologist must have a far wider vision than any laboratory chief can possibly have.

In the third year, the student should be taught to correlate his knowledge of anatomy, physiology, and pathology in a clinical application. The instruction should also be in the nature of a review, which intensifies the mental impression that may have been made previously. After such preclinical teaching as has been outlined there should be a striking difference in the student's receptivity to the clinical application of roentgenology compared to that which is possible when the attempt is made to teach him pathologic roentgenology only at this time, and without any preliminary introduction. The third year instruction under the radiologic staff, who can best correlate previous, present and future teaching, should cover a period of from sixteen to eighteen weeks during the last half of the year, with a weekly demonstration lecture. Each one should be elementary and based only on typical pathologic cases or examples. All exceptional and confusing cases should be absolutely ex-

cluded, and as few illustrative ones used as possible. Continuous didactic lectures illustrated by numerous films or slides shown in rapid succession make but little mental impression on the student, who is still very much a novice. An ideal way would be to divide the class into small sections for demonstration purposes, with each member of the staff teaching a small group simultaneously. Few institutions are equipped to do this, however. While actual didactic lectures should be avoided as much as possible, a few of them are necessary, especially in connection with radiation therapy, which is preferably a fourth year subject, however.

In the fourth year, roentgenology and clinical medicine and surgery and the special branches should be still further correlated. The plan we have followed for a number of years has worked out very satisfactorily. A class section of about twenty students spends an hour a week for six to eight weeks in a medical roentgenologic conference in which the director or professor of radiology is the leader and with the medical staff in attendance. Individual cases with which the students are familiar are discussed from the standpoint of history and clinical observations by the medical staff. The roentgenograms are then demonstrated and the roentgenologic deductions presented. The students are requested from time to time to attempt roentgenographic interpretations and are urged to ask questions.

Similar conferences are held weekly on surgical cases, with the surgical staff in attendance. After the roentgenologic deductions have been made, the surgeon in charge of the case in question briefly reviews the operation and gives the operative observations. These conferences last throughout the fourth year, so that each student has from twelve to sixteen hours of instruction.

A similar plan is carried out with the pediatric staff, although student attendance is optional.

In addition to this, clinical medicine and surgery, and even some of the other specialties, should be taught with the use of roentgenologic data from roentgenograms as a part of the clinical picture of each case under discussion. Probably the subject of fractures is universally taught in this manner. The student will have a much better understanding of what the roentgenograms are intended to convey if he has had such preliminary training as has been outlined. In more or less didactic teaching of clinical subjects, roentgenograms of typical cases might well be shown, with normal roentgenograms for comparison, as a part of the clinical picture of each disease.

As has been previously stated, the preferable method of teaching radiation therapy would be through the agency of a cancer clinic group. The student should be taught unbiased views in regard to the indications and limitations of radium, roentgen rays, surgery and electrothermic methods. He then understands the necessity for early diagnosis and is prepared to go out and choose between accepted and unethical and unscientific methods of treatment.

The foregoing recommendations prescribe what would seem to be an ideal method of teaching radiology to undergraduate medical students and its correlation in a practical way with preclinical and clinical specialties. They are not entirely personal views but include also the ideas and even the practices of many teachers of radiology. They are offered for the purpose of general consideration with the hope that they may assist in the betterment of at least a small part of the medical curriculum.

THE TEACHING OF RADIOLOGY TO INTERNS¹

By JAMES T. CASE, M.D., CHICAGO
From the Northwestern University Medical School

THE average physician cannot boast of great familiarity with the conduct or interpretation of roentgen examinations, or of adequate comprehension of the possibilities of diagnostic aid to be obtained from X-ray studies. His contact with X-ray problems consists in the main of emergency cases in which fractures or dislocations are suspected, and occasional reference of cases to X-ray laboratories for a "picture" of the lungs, stomach, or urinary tract. He has not appreciated that, in addition to skeletal diseases and injuries, roentgen studies may be applied with advantage to nearly all visceral disorders, including many diseases of the nervous system. He does not stop to realize that examination with the X-rays is much more complicated than the simple taking of a "picture", that it is really no more a simple laboratory procedure than an ophthalmic examination or a urinary tract examination or a gynecologic study, and that a clinical knowledge of the conditions entering into his problems is a necessary part of the preparation of the radiologist. The "picture" of the stomach turns out to comprise a careful fluoroscopic investigation supplemented by anywhere from three to a dozen or more roentgenograms in various positions and under various circumstances according to the individual case. The "picture" of the lungs proves to be much more involved, the patient requiring fluoroscopic study in the erect position at various angles, with films to record whatever may be questionable or of especial interest, and sometimes it is advisable to make a screen study of the patient in the horizontal, prone, supine or lateral position, and to record the results with the necessary films. All of

which sounds, and in actuality is, much more complicated than the simple word "picture" would imply, and yet to the layman who hears the X-ray study spoken of as a "picture," the physician's use of this term only serves to strengthen his impression that a roentgen examination is nothing more than some sort of glorified photography.

The remedy lies in some measure in the widening of the horizon of the general practitioner in relation to X-ray matters by having the radiologists of the country enter into a campaign of education through staff meetings, county society and other medical meetings. To a certain degree, perhaps as rapidly as possible, this is being carried on at the present time, but the logical and most important step is to carry this education to the young graduates of medical schools while they are in their intern year.

Medical students receive a certain amount of instruction in radiology, mostly in connection with X-ray investigations made in relation to the various patients with whom they come in contact during their clerkships and clinics. In addition, most medical school curriculums now include required didactic courses in roentgenology, usually in the Senior year, and in many there are well trained roentgenologists who carry on excellent systematic courses of lectures and demonstrations to the students during both the Junior and the Senior years. Many schools make it possible for their students during their Senior year to serve a clerkship in the X-ray department. Thus, when the graduate of to-day comes to the hospital as intern he already possesses a good foundation for further elaboration of his knowledge of roentgenology.

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80 per cent offer instruction in X-ray work. In some, provision is made for the rotation of the interns to include a brief service in the roentgen department, and in some of the larger hospitals there is a special X-ray internship. In others, occasional lectures are arranged to be given by the members of the staff of the roentgen department so that the interns may have more or less systematic instruction in roentgen diagnostics and therapy. In most hospitals, however, observation leads me to believe that the X-ray instruction given interns is desultory and not under definite check. The idea seems to be that the intern may absorb his knowledge of radiology while making rounds with the attending physicians and surgeons. In small institutions this is perhaps a necessary procedure, but in hospitals where the services of a trained roentgenologist are available it would be well for the interns to get from him also his slant on the meaning of the roentgen examination. The attending staff has a duty and a privilege in collating the roentgen observations with the other clinical and laboratory aspects of each case, whereas the roentgenologist, no matter how familiar he may be with the clinical and laboratory observations in a case, must not read into his roentgenologic interpretation more than can be supported by the X-ray evidence. It is well for him to know as much as possible about each case, the more the better, but he should not put into writing as a part of the X-ray report any statement which cannot be substantiated by the X-ray evidence.

PROGRAM OF INSTRUCTION

It is evidently quite necessary, if interns are to be given X-ray instruction, to formulate a definite program which can be followed out. Let me consider some of the things I believe it essential for an intern to learn about the X-rays. Naturally, the extent to which this ideal can be carried out depends on the size of the hospital.

of secondary radiation, and the physical and biologic laws that apply to them. This may be accomplished by reading text-books, and it may have been done by some of the interns but a systematic review should be made of the subject. Only by appreciating the physical facts will the intern ever learn to take care of himself and his patients during roentgenologic investigations and therapy. He should be taught the necessity of constant protection by lead-rubber aprons and gloves, to conduct roentgen examinations with expedition, to realize that proper filters must be kept in place between the source of the rays and the patient, whether for therapy or for examination, and that that most memorable of laws, the inverse square law, applies to all radiation (including radium and ultra-violet rays). He should learn that the patient becomes a potent source of secondary radiation against which protection must be provided.

2 *The scope of roentgen examinations.* In his daily work the intern learns the general applicability of the roentgen rays to diagnosis, but the refinements of X-ray diagnosis should be systematically brought to his attention by didactic work. There are conditions not encountered in daily work in which the average physician will not think of a roentgen examination, for instance, acute intestinal obstruction, subphrenic abscess, pulmonary and pleural abscesses, perirenal abscess, certain abdominal abscesses, the measurement of the size and the position of certain viscera such as the liver and spleen, and the application of opaque oils and other opaque media to the study of the sinuses and fistulas as well as certain organs into which such opaque oils may be introduced. The localization of foreign bodies is a field in which most physicians do not know (or else have forgotten) the value of the X-rays. Physicians with experience on the front during the War had brought home to

localizing foreign bodies of all kinds, special emphasis being placed on fluoroscopic methods, yet how few seem to remember at this short interval since the War the efficiency and the speed of the fluoroscopic methods of routine use in war hospitals during hostilities. Peace-time studies have added non-opaque foreign bodies in the respiratory tract to the opaque foreign bodies detectable with the roentgen rays. Naturally the intern, even in his student days, became familiar with the scope of the roentgen study of the gastro-intestinal tract, the urinary tract, the lungs and bronchi, the heart and great vessels, and the skeletal injuries and diseases. It is important that in all autopsy and staff conference discussions the roentgen observations should be presented by the radiologic department and carefully correlated with the clinical and autopsy aspects of each case. It is a practice in one hospital, at least, to present at the autopsy room a roentgenogram of the chest, made postmortem, to bring further down to date the X-ray data on the thorax.

3 Fluoroscopic control of the reduction of fractures and dislocations and in the removal of foreign bodies. Some of the larger hospitals are equipped for biplane fluoroscopy for use during the setting of fractures and the reduction of dislocations, but the very accessibility of such apparatus may tend to relax one's vigilance against damage by the X-rays to the patient and staff. Every year new cases are brought to attention in which irreparable damage has resulted to physicians from injudicious fluoroscopy. When special apparatus is not provided for such work, improvisation can be made in the roentgen department or a portable X-ray instrument and a hand fluoroscope may be carried to the operating room, under which circumstances the danger of damage by the X-rays to the staff is greatly increased, to say nothing of danger from possible explosion from unwise choice of anesthetic agent to use under such

circumstances. These precautions are all the more important if it is sought to use the roentgen aid in the extraction of an opaque foreign body. Here again one seems to see very little effort to use the fluoroscopic aid so widely taught in military surgery. Time and again one sees surgeons attempting the removal of superficially located foreign bodies in the good light of the operating room when, by the aid of the fluoroscope and a proper technic of protection against surgical contamination and roentgen damage, the offending substance may be extracted with great saving of time and no danger from the X-rays.

4 Roentgen interpretation. To develop skill in reading roentgenograms and in translating the appearances made manifest by fluoroscopy there must be opportunity for observation of and participation in fluoroscopic and X-ray film examinations, and for sharing in the conference at which the roentgenologist puts together into the written report the X-ray evidence shown by films and screen. To make this of teaching value, it is important that the roentgen department be furnished with a statement of the problem in each case referred for examination. It is not enough to refer the patient merely for an examination of such and such part, the examination desired should be stated, but, most important of all, the problem should be stated clearly. The referring physician had some reason for sending the patient for examination in the roentgen department, what was that reason? A tentative diagnosis would be ideal, but practically it seems impossible to get the co-operation of staff members to that extent. It is possible to insist on knowing the question that was in the referring physician's mind when he wrote the requisition and he should take the time and trouble to state his problem briefly.

5 Roentgen terminology. Terminology is of importance in the instruction of interns. It is difficult to change the habits of

a lifetime and, on the other hand, it is relatively easy to instruct young people just entering their practical experience To a man who has all his life spoken of roentgen examinations as "having a picture taken," and who has been guilty of sending his patients into the X-ray department for an "X-ray picture of the gastro-intestinal tract," an "X-ray picture of the lungs," and of this, that, and the other thing, it is useless to talk about terminology But the younger men are susceptible to persuasion and rule in this matter, especially when reason is used in talking with them There is a certain dignity which belongs to all branches of the medical profession, and it is well to maintain that dignity The surgeon does not speak of making such and such a "gash" or "slash" to "dig out" the appendix, that would be exceedingly undignified He makes such and such an "incision" to "resect" the appendix One does not "dig out" the prostate through a low belly "slash", he "enucleates" the prostatic tumor through a "suprapubic incision" Just so, in roentgen terminology it is possible with a little care to school oneself to dignified language and to speak of "X-ray films," "X-ray examination," and "X-ray study" if one is determined that his tongue cannot negotiate the more cumbersome "roentgenogram" or "roentgen study" One of my dear friends protested that he could not curl his tongue around "roentgenogram," yet within two or three minutes he was talking about a nice case of urethral obstruction in which he performed a "ureteromeatotomy"! Proper terminology aids materially in the collection of fees that are necessary to carry on X-ray work adequately The American Medical Association has published an acceptable list of radiologic terms

6 *Therapy* The field of roentgen therapy is so complicated that it is to be doubted whether more can be done in the way of instruction during the intern year

ment, the selection of cases, the realization that it is possible to make accurate dosage, and the limitations of the method

Circumstances will determine how far such a program can be carried out in the individual hospital In large hospitals, with internships of from eighteen months to two years, it is quite reasonable that a portion of this time be given to the roentgenologic department, each intern spending a while in that department as a participating assistant Such a stay should be for not less than two months, and three would be better The practice of assigning an intern to the X-ray department instead of a place on a rotating service should be condemned, no fellow in the roentgen department should be accepted until after having served his regular internship, and preferably after a few years of general practice Failure to observe this precaution results in unbalanced training, which soon becomes evident in the practical work of the fellow

In some hospitals the interpretation is done at the same time during which the members of the attending staff are making their rounds, so that it is difficult for the interns to participate in the reading of the roentgen examination In such cases it is feasible to arrange a certain hour at the close of the forenoon or at the end of the day for revision of some of the more interesting of the X-ray cases of the day It is also possible for the staff to arrange that the roentgenologist shall give a series of systematic lectures and demonstrations covering the X-ray instruction deemed necessary

Much good will have been accomplished if the intern on leaving the hospital can carry with him a thorough appreciation of the scope and limitations of the roentgen examination in various disease conditions, its value and dangers in the control of fracture and foreign body work, and its place with radium in the treatment of many benign lesions as well as in the management of malignant disease

THE POST-GRADUATE AND GRADUATE TEACHING OF RADIOLOGY¹

By ARTHUR U DESJARDINS, M D, ROCHESTER, MINN
From the Section on Therapeutic Radiology, Mayo Clinic

RADIOLOGY is still a comparatively new branch of medicine, but its rapid development during the last thirty-five years, and especially during the last ten years, is deservedly attracting widespread attention. Moreover, its relations to many other phases of medicine are increasing day by day. In several phases of medical practice, in fact, radiology has already become an indispensable factor. Such evolution has been so rapid that, although many of the better medical schools provide more or less substantial instruction for under-graduates, little effort has yet been made to organize and provide thorough post-graduate or graduate courses. In this respect America has allowed itself to fall behind several European countries. In England, France, and Sweden, for instance, the teaching of radiology is well organized and has been placed on a higher plane than in any school in this country. This deficiency is now crying for correction.

Any consideration of post-graduate and graduate instruction in medical radiology must take into account a number of factors: the present status of the subject as it affects, and is affected by, other phases of medical practice, the existing plane of under-graduate teaching of radiology, the number of qualified teachers available, and the objects which an ideal system of instruction should seek to attain. It must be obvious that, without an ideal to strive for or a definite objective to attain, it would be difficult or impossible to construct a plan that could be expected to yield the desired result. In other words, the first essential is to know

what is the desired result and to keep it clearly in mind. The main object of post-graduate instruction in radiology, it seems to me, should be to develop full-fledged specialists in this branch of medicine, masters of the subject, thoroughly equipped to practise the specialty, and worthy of public confidence. This, then, should be the ideal toward which we should strive. But before constructing a plan to achieve this result, it is important to inquire into the present status of radiologic practice. In a recent analysis I² have attempted to point out some of the undesirable conditions that characterize such practice at the present time, such as the comparatively low standards that countenance the reference of patients by their attending physicians to so-called laboratories operated on a commercial basis by unqualified laymen, the dependence of many physicians on interpretations of roentgenologic data by non-medical technicians, the treatment of patients by technicians without supervision by medically trained therapeutic radiologists, and the dearth of teachers of academic caliber. These different factors are so closely interrelated that to analyze and set forth precisely the influence of each factor is not a simple task. Nor is such exact distinction necessary. It is quite enough to know that these factors collectively constitute a sort of vicious circle. The one point at which this circle can be most effectively broken is that which relates to post-graduate instruction, because the present lack of such instruction furnishes the best opportunity for constructive action. It is true that the break is rendered difficult by the relative paucity of teachers, but the

¹Read before the Annual Congress on Medical Education, Medical Licensure and Hospitals, Chicago, Feb 16, 1932. Reprinted by permission from the *Journal of the American Medical Association*, March 19, 1932, NCVIII, 933.

²A U Desjardins, The Status of Radiology, Jour Am Med Assn, May 23, 1931, NCVI, 1749-1753.

number of teachers can be increased only by such a break

Besides developing full-fledged specialists, however, the scheme of instruction should also include short courses in the different phases of diagnostic and therapeutic radiology. This would satisfy a widespread demand, would spread the knowledge of advanced methods, and would tend to raise the general level of radiologic practice.

A well-considered scheme of instruction, therefore, should provide

1 Short, strictly post-graduate, courses in different phases of diagnostic and therapeutic radiology for graduate physicians who may merely wish to keep informed on the value of various new methods or to prepare themselves to utilize one or another phase of radiology, and also for radiologists who may want to keep abreast of the newer technical developments and methods.

2 A comprehensive, graduate course of systematic and thorough instruction in every phase of radiology for physicians who desire to qualify as specialists.

The short courses should be open to any graduate physician, regardless of the character of his practice. This suggestion will no doubt be objected to by some, who may feel that to allow any physician to take such courses must result in encouraging physicians in general to conduct roentgenologic procedures or radiotherapy for themselves and in restricting the field of the radiologic specialist. This objection, I am convinced, is not strong. Although it must be conceded that the broad privilege of taking short courses would undoubtedly lead an increasing number of physicians to interest themselves in radiology and perhaps to employ it in their own work, I feel certain that instead of limiting the field of the specialist it would extend it. The more widespread the realization of the usefulness of different phases of radiology, the greater the likelihood that the real value of highly qualified

... specialists will receive the recognition it de-

serves. Certainly, it cannot be said that the short post-graduate courses in ophthalmology have lowered the level of ophthalmologic practice as a whole, on the contrary, they have led an increasing number of physicians to recognize the importance of high grade ophthalmology, and the status of this branch of medicine has risen as the number of qualified specialists has increased. To be sure, it would be fallacious to assume that this achievement has resulted from the provision of short post-graduate courses, the point is that such short courses do not appear to have acted as a deterring factor, and there are reasons for thinking that they have had an opposite effect. Therefore, the fear that short courses of instruction in radiology for graduate physicians may interfere with the general program of placing the post-graduate teaching and practice of radiology on a higher plane seems unwarranted.

Among the subjects in which short courses might well be provided are

Physics of roentgen rays

Physics of radium

The quantitative and qualitative measurement of roentgen rays and radium

Roentgenologic technic

Roentgenologic interpretation

Roentgenologic diagnosis of diseases of bones and joints

Roentgenologic diagnosis of diseases of the respiratory tract

Roentgenologic diagnosis of diseases of the gastro-intestinal tract

Roentgenologic diagnosis of diseases of the urinary tract

Roentgenologic localization of foreign bodies

The newer methods of roentgenologic diagnosis

The biologic principles of radiotherapy

The technic of roentgen therapy

The technic of radium therapy

Physicians taking such courses should be entitled only to a certificate of attendance and should not be required to pass any

examination, unless the number of short courses taken is sufficient to enable them to qualify as specialists. In this event, they should be allowed to take a comprehensive examination, and, if they succeed in passing it, they should be entitled to a certificate and to the title of specialist. The courses should be arranged so as to crowd as much information as possible in the time allowed and should consist of both didactic and laboratory exercises or practical work. The aim of the lectures should be to set forth principles and to explain their application, so that those who take such courses may be able to solve their own problems by analyzing the factors involved and applying fundamental laws. Neither didactic nor practical instruction alone can serve the purpose. Laboratory exercises should be chiefly in the form of demonstrations, because to expect the average short-course student to derive much information from being allowed to fuss and stew in a laboratory for two hours a day for six weeks would be likely to prove a delusion. Often it would only serve to waste the time of the student and of the instructor. In general, a well conducted demonstration would be much more effective. In certain courses, however, in which it is essential for the student to familiarize himself with technical procedures or with the operation of measuring or other instruments, individual practice under the supervision of the instructor is essential.

COMPREHENSIVE GRADUATE COURSE

The comprehensive course leading to a degree such as that of Master of Science in Radiology or Doctor of Radiology should be conceived along the broadest possible lines. It is difficult to see how anything like a thorough course of instruction can be compressed into less than three years. Any attempt to effect undue compression must necessarily result in sacrificing thoroughness and, therefore, quality.

To insure that candidates may be able to take full advantage of the course, they should be subjected to reasonably rigid requirements, as far as antecedent instruction or training is concerned. The privilege of registration should be restricted to graduates of Class A schools and preference in selection should be given, or selection should be limited to those who have had, as part of their pre-medical training, college courses in physics and biology or their equivalent. An internship of at least one year in a Class A hospital should also be required as a preliminary to registration.

The first year of the graduate course should be devoted to anatomy, physiology, and pathology and to the physical aspects of radiology. One-half year of concentrated training in anatomy, physiology, pathologic anatomy (otherwise known as gross pathology), and microscopic pathology would provide the strongest possible foundation for both roentgenologic diagnosis and radiotherapy. A radiologist cannot possibly have too much knowledge of anatomy and pathology. Ability in roentgenologic interpretation depends in about equal measure on knowledge of anatomy and pathology, and these subjects are about equally important for roentgen and radium therapy. To meet the needs of roentgenologic diagnosis, instruction in anatomy should lay particular stress on landmarks and relations of special importance in roentgenology and on the developmental phases of bones. Physiology should be taught chiefly in the form of a review, but special attention should be given to the more significant radiologic considerations.

The second half of the first year should be given over to radiologic physics, instruction in which should include both didactic lectures and laboratory exercises. The lectures or conferences should be as practical as possible and should be planned so as to explain and demonstrate physical principles.

as they apply to different phases of radiology. As much as may be feasible, examples should be selected from material related to that subject, and demonstrations should be arranged in the same way. The object of the laboratory exercises should be to serve as additional demonstration of principles, to explain the construction and operation of apparatus, and to familiarize the student with physical methods and instruments for measuring electrical potential and resistance, the quality and quantity of roentgen rays, and all other measurable factors that enter into the scientific practice of radiology.

The second year should be fully taken up by diagnostic roentgenology. Not only should the students be taught how to interpret roentgenograms, but they should be required to spend a good part of their time in performing, under the guidance and supervision of qualified instructors, the numerous technical procedures incidental to the present-day practice of diagnostic roentgenology. To watch some one else and to do things oneself are two quite different things. The one may be a useful preliminary to the other, but in no way can the former be regarded as a substitute for the latter. One who has not become thoroughly familiar with every step of a procedure by actual experience can never be in a position to direct subordinates intelligently. By every possible means, therefore, students should be induced to regard themselves as working members of the department in which they are receiving instruction and should be made to feel some measure of responsibility for whatever work they may be engaged in. This is the only way by which any one can expect to become really proficient. Roentgenography and roentgenoscopy have become so important that familiarity with every phase of their utilization in the diagnosis of diseases of bones and joints, of the digestive, respiratory and urinary tracts, of

the nervous system, and also for the recognition and localization of foreign bodies, requires a detailed knowledge of many methods and of the variations in technic by means of which maximal information can be elicited under different circumstances. To become proficient in every detail of roentgenologic diagnosis in one year does not allow any time for frivolity. The question is, is one year really sufficient? Certainly, it can be accomplished only by careful planning and correlation and by the utmost economy of time.

Perhaps the foregoing results can best be achieved by arranging for the students to concentrate their attention, for periods of two or three months, on the roentgenologic procedures involved in the diagnosis of lesions affecting each of the groups of structures or organs previously mentioned. However, a fixed schedule is out of the question, because considerable latitude must be allowed in adjusting the details of the scheme of instruction to the circumstances of the institution in which the course is given. Besides instruction and practical training in roentgenography and roentgenoscopy, the students should be taught the photographic and chemical aspects of roentgenography and the methods of protection required for the safe practice of radiology.

Throughout this part of the course it is desirable that contact with clinical medicine and surgery be maintained. In some institutions the diagnostic roentgenologist may be obliged to work with little knowledge of the clinical features of the cases examined. At best, this is to be regarded as an unfortunate necessity, but never should it be looked on as an ideal. On the contrary, the closer the relations between medical or surgical clinicians and the roentgenologist, and the more knowledge the latter may have concerning the cases he examines, the more valuable should be his opinion.

The third year should be given over to

therapeutic radiology, including roentgen rays, radium and, if possible, ultra-violet radiation. The field of radiotherapy, once so restricted, is now rapidly extending, and every radiologist worthy of the name should receive as broad and as thorough training in the therapeutic as in the diagnostic aspect of this branch of medicine. The conspicuous and widespread lack of such training, and of the clinical and pathologic foundations on which it rests, are among the most glaring deficiencies of present-day American medicine. Owing to the general neglect of this phase of the subject, but chiefly because of the lack of qualified instructors, few institutions are now in position to undertake such teaching. If this deficiency is to be corrected, a beginning must be made. For a time it may even be necessary for two or more institutions to pool their facilities and personnel.

Students should be required to take an active part in the examination of patients, in outlining their treatment and in preparing patients for irradiation, as well as in the actual administration of the treatment. I should be quite feasible to arrange the work so that, without any transfer of responsibility from those on whom the professional and legal obligations actually devolve, the students may yet have an appreciable share in all phases of such treatment. Only through some such scheme can they be made to realize the significance of many details, careful consideration of which and attention to which spell the difference between superior and inferior treatment. Too often the medical side of radiotherapy is neglected and the physical aspects are over-emphasized. Both should receive due consideration. Important as it is to know the quantity and quality of radiation most useful in dealing with different pathologic conditions, it is even more important to be able to recognize the disease at different stages, to ascertain the extent of the primary lesion and of secondary foci, to size up the general

state of the patient, and to adjust the treatment accordingly. Needless to say, the instruction in therapeutic radiology must be delegated to instructors of broad medical and radiologic experience. It may be contended that the general clinical, pathologic, dermatologic, surgical, gynecologic and other aspects of radiotherapy should be presented by specialists in the respective branches. But considerable difficulty may be encountered in finding specialists who have had sufficient experience with the radiologic aspects of their subject to qualify them for the task. To mention another example, few pathologists, and only a slightly greater number of practising radiologists, know much about the relative radiosensitivity of different varieties of cells and tissues. To be sure, the subject is still comparatively new, but, unless a start is made, such knowledge as we possess will be slow to diffuse.

On the whole, the most feasible arrangement at the outset will probably be to delegate the general teaching of the subject to the most experienced and the best informed therapeutic radiologist available. He, in turn, should arrange to have those phases of the subject with which he is not sufficiently familiar presented by qualified specialists. The strictly radiologic teaching should be supplemented by lectures on related aspects of clinical medicine, surgery and dermatology. Here again the need of combined didactic and practical teaching must be emphasized. This can be accomplished by means of lectures, but another effective, supplementary method is that of conferences or seminars at which certain of the students present a general review of some phase of the subject, which is then discussed by the instructor and by the other students.

The scope of roentgen therapy is distinctly broader than that of radium therapy, in that a wider variety of cutaneous, inflammatory, and neoplastic diseases are amenable

to treatment with roentgen rays than with radium. It must not be inferred, however, that the former subject should be allowed a greater proportion of time than the latter. An approximately equal period should be allotted to the two subjects. The therapeutic use of radium involves physical, clinical, and often surgical considerations, in which adequate knowledge, experience and judgment cannot be acquired hurriedly.

The program which I have ventured to outline would not be complete without the additional condition that, as part of his training, each graduate student should be required to undertake a piece of research on some phase of diagnostic or therapeutic radiology and to prepare a report or thesis based on such work. It is true that some, who may be brilliant in the practical aspects

of radiology, may not shine as investigators. The value of the research requirement does not lie so much in the actual results obtained as in making the student realize the importance of careful work and in the discipline which may cause him to realize that, even after an extensive course of study, he does not know everything.

I am aware that such a sketchy outline may be unsatisfactory and that some would undoubtedly prefer a more detailed plan. I have deliberately avoided this, however, because the conditions at each institution, and the personnel and facilities available, vary so much that the details of any scheme of instruction must be worked out by those who are familiar with the requirements on the one hand and with the local conditions on the other.

X-rays Most Destructive to Young, Growing Cells—X-rays in sufficient doses are destructive to all kinds of living cells, but they are most so to cells that are physiologically young and active. This is one of the basic physiological facts that underlie radiotherapy. Dr Arthur U Desjardins said in speaking before the American Association for the Advancement of Science. It follows from this principle that tissues that remain "chronically young" respond to X-ray dosages much smaller than those needed for effect on maturer tissues.

The most sensitive of all the cells in the hu-

man body are certain classes of white blood corpuscles, and the glands and other tissue masses where these are found most thickly are also very sensitive to the destructive rays. Dr Desjardins inclines to the opinion that the easy destructibility of these white blood cells is at the bottom of the value of X-ray therapy in certain inflammatory conditions. White blood corpuscles crowd around foci of infection, causing inflammation. The X-rays break them down, releasing the germ-destroying substances they have formed within themselves, and thereby hasten the death of the trouble-causing bacteria.—*Science Service*

A STATISTICAL STUDY OF RADIOLOGIC TEACHING IN THE MEDICAL SCHOOLS OF THE UNITED STATES AND CANADA

By LEON J MENVILLE, M D, F A C R, NEW ORLEANS

A REVIEW of the radiologic literature reveals many interesting articles appertaining to a lack of proper understanding by a certain number of clinicians and surgeons of the limitations of and indications for the roentgen ray and radium in the diagnosis and treatment of disease. It would appear from current reports that this misconception of radiology is widespread, that it is not restricted to the rural districts, but is evident as well in large medical centers.

Years ago, when little was known concerning the roentgen ray and radium, it was to be expected that few physicians, except those specializing in radiology, would have other than a little practical medical knowledge of these agencies. In recent years, the progress of radiology has attracted the attention of the medical world; its scientific achievements fill pages in the medical literature. The result is that this literature offers a splendid opportunity to all its readers to become acquainted with the fundamentals of radiology, so that there should be no excuse for the modern, progressive physician to be ignorant of the limitations of and indications for radiology in its application to medicine.

In spite of the many advantages which organized medicine offers its members, only a certain number avail themselves of this opportunity. Many will continue to grope in the dark as mind-blind physicians, without the faintest conception of just what a radiologist really is. They are unable to differentiate between a radiologist and a physician who manipulates an X-ray apparatus. In fact, many physicians believe that roentgenologic diagnoses are not necessarily the result of skill or a knowledge of

medicine. Their understanding is that the roentgenological examination is purely the result of mechanical apparatus so standardized that anyone familiar with its operation can and does make correct diagnoses. We have all experienced the embarrassment of having to refuse to make certain impossible roentgenologic examinations at the request of a referring physician, and likewise to decline the treatment of certain diseases not amenable to radiation therapy. For instance, a radiologist was requested to measure in inches the length and width of the mitral valve of a patient's heart, and when the referring physician was informed that the radiologist was incapable of performing such an examination, the physician became indignant, saying that he would refer his patient to someone who could. He did, but not to a radiologist—to a physician friend who owned an X-ray machine. In this connection, however, there are many physicians who have acquired a substantial knowledge of the importance of radiology in medicine, and frequently consult with the radiologist in the same manner as with the surgeon and other specialists.

It is not difficult to ascertain the reason for the existence of this general confusion, which, of course, is due to a lack of radiologic education. It must be remembered that many of these physicians attended medical school at a time when little was known about the roentgen ray and radium. The medical curriculum then allocated but very little, if any, time to radiology, consequently early medical graduates who have not kept in touch with the development of this branch have but a vague conception of it. It is unfortunate that such physicians must continue to be deluded by the false

RADIOLOGY

TABLE I—QUESTIONS 1 TO 7, INCLUSIVE

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De- partment? | Is the radiological teaching separate, or is it given in the De- partment of Medicine or Surgery? |
|--|--|----------------|------------|----------------------------|--|--|---|
| | Fresh man | Sopho- more | Junior | Senior | | | |
| University of Alabama School of Medicine, University, Ala. | 0 | 0 | | | | | |
| College of Medical Evangelists, Los Angeles, Calif. | 0 | 0 | 13 | 0 | As part of Medicine | Prof of Med | Medicine, in didactic and practical classes |
| University of Southern California School of Medicine, Los Angeles, Calif | 0 | 0 | 18 | 0 | As part of Medicine | Assoc. Clinical Prof of Med. (Radiology) | Clinically com- bined with medi- cine and surgery |
| Stanford University School of Medicine, San Francisco, Calif | 0 | 11 | 0 | 0 | As part of Medicine | Prof of Med (Radiology) | About half com- bined clinic, rest independent |
| University of California School of Medicine, San Francisco, Calif | 0 | 0 | | | Yes | Clinical Prof of Roentgenology | Sub Dept of Surgery |
| University of Colorado School of Medicine, Denver, Colo | 5 | 0 | 5 | 15 | Division of Surgery | Chief of Div of Radiology | With surgery |
| Yale University School of Medi- cine, New Haven, Conn | 0 | 0 | 12 | 60 elective clinical | Division of Medicine | Clinical Prof of Radiology | Combined with medicine |
| Georgetown University School of Medicine, Washington, D C | 0 | 0 | 15 | 0 | Yes | Prof of Roent- genology | Sub Dept of Surgery |
| George Washington University Medical School, Washington, D C | | | 16 | 42 C | Yes | Prof of Radiology | Separate |
| Howard University School of Medicine, Washington, D C | 0 | 0 | 22 | 0 | No | | With surgery |
| Emory University School of Medi- cine, Atlanta, Ga. | 0 | 0 | 45 | 8 | Yes | Asst Prof of Clinical Surgery | Division of Surgery |
| University of Georgia Medical Department, Augusta, Ga. | 0 | 0 | 0 | 36 | Yes | Prof of Clinical Radiology | Separate |
| Loyola University School of Medi- cine, Chicago, Ill | 0 | 0 | 48 | 0 | No | | Medicine |
| University of Chicago Graduate School of Medicine Division of Biological Science, Chicago, Ill | 0 | 0 | 0 | 22 | Division | Prof of Roentgenology | Professor listed in Dept. of Medicine |
| University of Chicago, Rush Medi- cal College, Chicago, Ill | 0 | 0 | Elective | | Yes | Assoc Clin Prof of Surgery (Radiology) | Separate |
| | | | 27 3 EC | 27 3 EC | | | |

C = Clinical FC = elective clinical

| | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks |
|--|--|--|--|
| | | | |
| Of what importance is the teaching of radiology considered in your school? | | | |
| Very important in diagnosis, plate reading, and general principles of X-ray therapy, but not to be taught as a technical specialty | Yes | Not equal to them | Gives only first two years of medical course One hour of second semester of Sophomore year given to introductory talk on radiology Twelve hours is given to the reading of X-ray films |
| Considered important | No | Yes, and rather more time is given to it than these specialties | In first semester of Junior year, one hour a week is spent in radiologic conference under the Dept. of Medicine, this centering around radiographic records of patients. We begin X-ray instruction in Anatomy and Physiology. With undergraduates, believe radiology should be stressed for diagnosis and treatment |
| Important Professors of medicine and surgery attend combined clinic (weekly) Ninety per cent of students elect optional courses | Not as a separate course | Yes | |
| The utmost, but is a tool of medicine and surgery | No | No | |
| Very important | Yes | Yes | |
| Of considerable value in diagnosis and is a therapy | Undergraduate no | With otolaryngology and ophthalmology, yes | In elective course, students spend about 60 hours in the department. In addition, conferences are held each week of the 6 weeks' course. Often students spend 12, instead of 6, weeks in the department |
| Of major importance | No | Yes | Six hours each in first 2 years given as radiologic anatomy. Forty-two hours in the fourth year spent in clinics |
| Very necessary and should be a separate department | Yes | Yes | |
| Of very great importance | See remarks | Clinically, yes | Roentgenology utilized in all clinical departments for diagnostic and observation purposes. It has become almost indispensable in clinical teaching and practice |
| Very valuable as diagnostic aid and every student should appreciate it | No | No | While radiologic teaching is given separately, X-ray films and reports are used in the instruction given in the Departments of Medicine and Surgery |
| Important | No | | |
| Essential | Yes | | The teaching is given in a conjoint course offered by several departments in co-operation |
| It is an elective subject | Yes | Yes | Junior and Senior students only at this college. An elective course, lecture, is given for 2 hours a week throughout the quarter and three quarters a year. The radiologist has ward-round students for 6 hours |

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De- partment? | Is the radiological teaching separate, or is it given in the De- partment of Medicine or Surgery? |
|---|--|----------------|--------|--------------------|--|--|---|
| | Fresh- man | Sopho- more | Junior | Senior | | | |
| University of Illinois College of Medicine, Chicago, Ill | 0 | 0 | 0 | 12 C 32 | No | Prof of Radiology | Separate |
| Northwestern University Medical School, Chicago, Ill | 0 | 0 | 0 | 40 33 | Yes | Prof of Radiology | Separate |
| Indiana University School of Medicine, Indianapolis, Ind | 0 | 0 | | 22 | No | Assoc. Prof of Roentgenology | Medicine |
| State University of Iowa College of Medicine, Iowa City, Iowa | No set number of hours | | | | Yes | Assoc. Prof of Roentgenology | With surgery, medicine, therapy |
| University of Kansas School of Medicine, Kansas City, Kans | 0 | 0 | 8 | 16 | Yes | Asst. Prof | Separate |
| University of Louisville School of Medicine, Louisville, Ky | 0 | 0 | 16 | 16 E | Yes | Instructor in Radiology | With surgery |
| Tulane University of Louisiana School of Medicine, New Orleans | 0 | 0 | 6 | 6 | No | Asst Prof of Medicine and Roentgenology | Medicine |
| Johns Hopkins University School of Medicine, Baltimore, Md. | 0 | 0 | 8 C | 8 C | No | Prof of Chem Roentgenology | Surgery |
| University of Maryland School of Medicine, Baltimore, Md. | 0 | 0 | 0 | 36 | Yes | Prof of Roentgenology | Surgery |
| Boston University School of Med- icine, Boston, Mass | 0 | 0 | 10 | 10 | No | Asst Prof | In medicine and surgery |
| Harvard University Medical School, Boston, Mass | 0 | 0 | 6 | 0 | No | Clin Prof | Medicine |
| Tufts College Medical School, Boston, Mass | 0 | 18 | 12 | | Yes | Prof of Radiology | Separate |
| University of Michigan Medical School, Ann Arbor, Mich | 0 | 0 | 30 | 0 | Yes | Prof of Roentgenology | Separate |
| Detroit College of Medicine and Surgery, Detroit, Mich | 0 | 0 | 12 | 12 | Yes | Prof of Roentgenology | Separate |
| University of Minnesota Medical School, Minneapolis, Minn | | | 33 | 11 | Yes | Prof | Separate |
| University of Mississippi School of Medicine, Oxford, Miss | | | | | No | | With medicine and surgery |
| St Louis University School of Medicine St Louis, Mo | 0 | 0 | 32 | Demonstra- tion | Yes | Prof and Director Radiology | Separate |
| Washington University School of Medicine, St Louis, Mo | 0 | 0 | 0 | 0 | Yes | Prof of Radiology | Both |

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks | |
|--|--|--|---|--|
| | | | | |
| Of great importance. | No | Yes | Students also receive 12 hours' instruction in the dispensary, examining and interpreting radiograms | |
| Of much importance | Impossible at present | No | | |
| Of great importance. | Yes | Yes | The radiologic instruction in the Junior year is incidental to clinical work by clinicians | |
| Same as for other laboratory work in diagnosis and therapy | Not a great deal more | Not on a parity but as adjunct | | |
| | No | Yes | | |
| | No | Yes | | |
| It is considered of definite importance. | In some, more, in others, not | Yes | | |
| Two hours demonstration weekly for 8 weeks | No | No | | |
| Of the utmost importance | Yes | Yes | | |
| Quite important | No | Depends on personnel of department | In the Senior year 10 hours are given in sections and work in all clinical subjects | |
| | Yes | | In the Junior year 4 hours are given by courtesy of the medical staff. There should be instruction in normal X-ray anatomy during the first and second years | |
| | Yes | Yes | In the Junior year, the work is clinical, in the Senior year, the course is elective. Elective one month's course | |
| Very All students follow every film of every patient assigned to them | Yes | Yes | Also 32 section hours | |
| Highly important | If practicable | Yes | The work in radiology is supplemented by practical work in connection with medicine and surgery | |
| Very important | No | Yes | The professor of radiology offers an elective in X-ray anatomy for Freshmen and Sophomores, scheduled among the anatomy classes. The department participates in the medicine, surgery, etc., courses and offers electives | |
| Its importance begins in the Sophomore year | No | Not before Junior year | Only the first two years of the medical course are given. Physicians and surgeons demonstrate X-ray films to the classes | |
| On equal basis with other subjects according to semester hours | Possibly more than some give | Yes, we are doing just that | In the Junior year, the course consists of lectures, demonstrations, and quizzes | |
| First | Yes, however, do not see how more time can be found | Yes | Here there is little didactic teaching of any subject | |

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De partment? | Is the radiologi cal teaching separate or is it given in the De partment of Medicine or Surgery? |
|---|--|---------------|--------------------|----------|--|---|--|
| | Fresh man | Sopho more | Junior | Senior | | | |
| Creighton University School of Medicine, Omaha, Neb | 0 | 0 | 16 | | Yes | Prof | Surgery |
| University of Nebraska College of Medicine, Omaha, Neb | 0 | 0 | 34 | 16 | Yes | Full Prof | Separate |
| Albany Medical College, Albany, N Y | 1 | 10 | 22 <u>8 C</u> | 36 C | No | Clin Prof Roentgenology | With surgery |
| Long Island College Hospital, Brooklyn, N Y | | | | | No | Prof Clin Radiology | With medicine |
| University of Buffalo School of Medicine, Buffalo, N Y | 0 | 0 | 0 | 0 | No | | With medicine |
| Columbia University College of Physicians and Surgeons, New York, N Y | 0 | 0 | 8 | 16 | No | Assoc. Prof of Medicine | With medicine |
| Cornell University Medical Col- lege, New York, N Y | 0 | 10 | 31 | Elective | Yes | Prof of Radiolog | With medicine and surgery |
| New York University, New York, N Y | 0 | 0 | 11 <u>32 ST</u> | 25 E | Yes | Prof of Roentgenology | Separate and in medicine, surgery and pediatrics |
| New York Homeopathic Medical College and Flower Hospital, New York, N Y | 0 | 0 | 33 | 0 | Yes | | With surgery |
| University of Rochester School of Medicine, Rochester, N Y | 0 | 0 | 32 | 32 | Yes | Assoc. Prof of Med | In both |
| Syracuse University College of Medicine, Syracuse, N Y | 2 | 0 | 0 | 60 | Yes | Prof Clin. Radiology Prof of Radio- logical Research | Fundamentals separate |
| University of North Carolina School of Medicine, Chapel Hill, N C. | 0 | 0 | | | | | |
| Duke Univ School of Medicine, Durham, N C. | | | | | | | |
| University of No Dakota School of Medicine, Grand Forks, N D | | | | | | | |
| | See remarks | | | | Yes | Assoc. Prof Roentgenology | Medicine |

C = clinical ST = section teaching E = elective

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks |
|--|--|--|--|
| An important adjunct to diagnosis and treatment | Not as independent subject | Hardly | The practical work is in conjunction with surgery and medicine, the didactic, separate. In the Senior year, 11 hours are devoted to instruction in the departments at the hospitals |
| Indispensable. | Not here | Yes | |
| Practically the same amount of teaching hours as allotted to specialties under surgery | Yes | Yes | The Freshman instruction is in conjunction with the course in gross pathology. Sophomore, with topographic anatomy, 8 clinical hours are given to radiology in the Junior year, and 36 in the Senior year |
| Important as diagnostic aid | See remarks | | No didactic lectures are given. Believe only sufficient time should be given radiology as is necessary in teaching undergraduate methods of diagnosis |
| Very essential | See remarks | | Enough time should be given to emphasize its importance as diagnostic aid and therapeutic agent. Also, radiology is an essential part of medical curriculum |
| Great importance. | No | See remarks | The Junior work is demonstration, the Senior, half diagnosis and half interpretation of films. Radiology also included in every course in which X-ray is used in diagnosis |
| Very important | Not separated from clinical | Yes | |
| Of great importance | More in some, less in others | I do not see how a comparison can be made | Here radiotherapy is a separate department. Therefore, here it would seem that roentgenology is taught as a diagnostic procedure and should rank as any other particular unit which teaches a specific method of diagnosis, as clinical pathology or physical diagnosis. I do not see how it can be compared with otolaryngology, dermatology, or ophthalmology, these being structural divisions having their own problems of pathology, physiology, diagnosis, and treatment |
| | Yes | Yes | |
| Of great importance if the therapeutic side is properly developed as well as the diagnostic. | | Yes. It is more than parity here | The danger of radiology is that it tends to supplant direct physical examination and should not be allowed to do so |
| | Not here | Depends on local situation and tendencies of particular school | |
| | | | Gives only the first two years of the medical course. No course in radiology is given |
| Great | Yes | Yes | No didactic lectures given in any subject. Juniors and Senior students have 2 hours per week of X-ray clinics or demonstrations |
| | | No | Gives only the first two years of the medical course. Elective course in radiology given in physics |

RADIOLOGY

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De- partment? | Is the radiolog- ic teaching separate or is it given in the De- partment of Veter- inary Surgery? |
|---|--|----------------|--------------------|----------|--|--|---|
| | Fresh- man | Sopho- more | Junior | Senior | | | |
| Creighton University School of Medicine, Omaha, Neb | 0 | 0 | 16 | | Yes | Prof | Surgery |
| University of Nebraska College of Medicine, Omaha, Neb | 0 | 0 | 34 | 16 | Yes | Full Prof | Separate |
| Albany Medical College, Albany, N Y | 1 | 10 | 22 <u>8C</u> | 36 C | No | Clin Prof Roentgenology | With surgery |
| Long Island College Hospital, Brooklyn, N Y | | | | | No | Prof Clin Radiolog | With medicine |
| University of Buffalo School of Medicine, Buffalo, N Y | 0 | 0 | 0 | 0 | No | | With medicine |
| Columbia University College of Physicians and Surgeons, New York, N Y | 0 | 0 | 8 | 16 | No | Assoc. Prof of Medicine | With medicine |
| Cornell University Medical College, New York, N Y | 0 | 10 | 31 | Elective | Yes | Prof of Radiolog | With medicine and surgery |
| New York University, New York, N Y | 0 | 0 | 11 <u>32 ST</u> | 25 E | Yes | Prof of Roentgenology | Separate and in medicine, surgery and pediatrics |
| New York Homeopathic Medical College and Flower Hospital, New York, N Y | 0 | 0 | 33 | 0 | Yes | | With surgery |
| University of Rochester School of Medicine, Rochester, N Y | 0 | 0 | 32 | 32 | Yes | Assoc. Prof of Med | In both |
| Syracuse University College of Medicine, Syracuse, N Y | 2 | 0 | 0 | 60 | Yes | Prof Clin. Radiology Prof of Radiolog- ical Research | Fundamentals separate |
| University of North Carolina School of Medicine, Chapel Hill, N C | 0 | 0 | | | | | |
| Duke Univ School of Medicine, Durham, N C | See remarks | | | | Yes | Assoc. Prof Roentgenology | Medicine |
| University of No Dakota School of Medicine, Grand Forks, N D | | | | | | | |

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks | |
|---|--|--|---|--|
| | | | | |
| An important adjunct to diagnosis and treatment | Not as independent subject | Hardly | The practical work is in conjunction with surgery and medicine, the didactic, separate. In the Senior year, 11 hours are devoted to instruction in the departments at the hospitals | |
| Indispensable. | Not here | Yes | | |
| Practically the same amount of teaching hours as allotted to specialties under surgery | Yes | Yes | The Freshman instruction is in conjunction with the course in gross pathology. Sophomore, with topographic anatomy, 8 clinical hours are given to radiology in the Junior year, and 36 in the Senior year | |
| Important as diagnostic aid | See remarks | | No didactic lectures are given. Believe only such time should be given radiology as is necessary in teaching undergraduate methods of diagnosis | |
| Very essential | See remarks | | Enough time should be given to emphasize its importance as diagnostic aid and therapeutic agent. Also, radiology is an essential part of medical curriculum | |
| Great importance. | No | See remarks | The Junior work is demonstration, the Senior, half diagnosis and half interpretation of films. Radiology also included in every course in which X-ray is used in diagnosis | |
| Very important | Not separated from clinical | Yes | | |
| Of great importance. | More in some, less in others | I do not see how a comparison can be made | Here radiotherapy is a separate department. Therefore, here it would seem that roentgenology is taught as a diagnostic procedure and should rank as any other particular unit which teaches a special method of diagnosis, as clinical pathology or physical diagnosis. I do not see how it can be compared to otolaryngology, dermatology, or ophthalmology, these being structural divisions having their own problems of pathology, physiology, diagnosis, and treatment | |
| | Yes | Yes | | |
| Of great importance if the therapeutic side is properly developed as well as the diagnostic | | Yes It is more than parity here | The danger of radiology is that it tends to supplant direct physical examination and should not be allowed to do so | |
| | Not here | Depends on local situation and tendencies of particular school | | |
| | | | Gives only the first two years of the medical course. No course in radiology is given | |
| Great | Yes | Yes | No didactic lectures given in any subject. Junior and Senior students have 2 hours per week of X-ray clinics or demonstrations | |
| | No | | Gives only the first two years of the medical course. Elective course in radiology given in physics | |

RADIOLOGY

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De- partment? | Is the radiological teaching separate, or is it given in the De- partment of Medicine or Surgery? |
|---|--|---------------|--------|--------|--|--|---|
| | Fresh man | Sopho more | Junior | Senior | | | |
| University of Cincinnati College of Medicine, Cincinnati, Ohio | 0 | 0 | 0 | 16 | Yes | Prof of Radiology | Separate |
| Western Reserve School of Medi- cine, Cleveland, Ohio | 0 | 0 | 16 | 0 | No | Asst. Prof | With surgery |
| Ohio State University College of Medicine, Columbus, Ohio | | | | | No | | With surgery |
| University of Oklahoma School of Medicine, Oklahoma City, Okla | 0 | 0 | 0 | 18 | Yes | Assoc. Prof of Radiology | See remarks |
| University of Oregon Medical School, Portland, Ore. | 0 | 0 | 33 | 0 | Yes | Clin Assoc. in Radiology | With medicine |
| Jahnemann Medical College of Philadelphia, Philadelphia, Pa | 4 | 4 | 32 | 6 | Yes | Prof | Medical and therapeutic |
| Jefferson Medical College of Philadelphia, Philadelphia, Pa. | 2 C | 0 | 20 | 6 C | Yes | Prof of Roentgenology | Separate |
| Temple University School of Medicine, Philadelphia, Pa. | | | | | Yes | | |
| University of Pennsylvania School of Medicine, Philadelphia, Pa. | 0 | 0 | 16 | 0 | Yes | Prof | Separate |
| Women's Medical College of Pennsylvania, Philadelphia, Pa | 0 | 8 | 0 | 15 | Yes | Clin Prof of Radiology | Separate |
| University of Pittsburgh School of Medicine, Pittsburgh, Pa | 0 | 0 | 8 | 16 | Yes | Prof of Roentgenology | Separate |
| University of So Dakota School of Medicine, Vermilion, S D | 0 | 0 | | | | | |
| University of Tennessee School of Medicine, Memphis, Tenn | 0 | 0 | 22 | 0 | Yes | Assoc. Prof | Separate |
| Leharry Medical College, Nash- ville, Tenn | 0 | 0 | 0 | 32 | Yes | | Separate |
| Anderbilt University School of Medicine, Nashville, Tenn | 2 | 0 | 72 | 84 | No | Asst Prof Clinical Surgeon | Separate lectures |
| Taylor University College of Medicine, Dallas, Texas | 0 | 0 | 0 | 32 | No | | With surgery |
| University of Texas School of Medicine, Galveston, Texas | | | | | Yes | Assoc. Prof | Separate |
| University of Utah School of Medicine, Salt Lake City, Utah | 0 | 11 | 0 | 0 | No | | |

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks |
|---|--|--|--|
| It is a minor department | Not here for undergraduate students | Yes | In connection with anatomy, Freshmen see fluoroscopic demonstrations, Juniors, in connection with dispensary work. |
| Great | Only in conjunction with medical and surgical teaching | Yes | |
| Important branch of surgery | Not with present crowded curriculum | No | No special course in radiology, it is given in regular work in surgery |
| Considered an important part of the courses in medicine and surgery by hospital staff and faculty | Not at our school | Not sure it would be considered so | In Senior year, 1 hour a week given to chest and 1 hour to gastro-intestinal. Patient examined under internist, then brought to X-ray department and physical signs and radiographic evidence correlated |
| Great importance | Probably | No | In all clinical departments, considerable attention given radiology, from diagnostic and therapeutic standpoints |
| On an equal basis with physical diagnosis | Yes | Yes | |
| Contributory | No | Not quite | In Freshman year, 2 hours are given in conjunction with anatomy, in Sophomore year, 6 hours in laboratory |
| Important | | Yes | |
| Great importance | Probably not | I think so | Thirty hours of conferences included in medicine, surgery, pediatrics, neurology |
| Of great importance but must be limited in hours to proportionate allotment of total curriculum time | | Radiology is not an isolated specialty | Students follow their ward cases through the X-ray department |
| Of great importance | No | Yes | |
| | | | Gives only the first two years of the medical course |
| A minor, but required of all graduates | No | Yes | |
| Of prime importance | | Yes | |
| Radiology ranks after general medicine, surgery, pediatrics, and gynecology, and rates above special branches | Yes | Yes | All radiologic courses are elective, as tendency at this school is away from required courses |
| Of great importance | No | Not for undergraduate teaching | |
| An elective course here, only students averaging 80 for the first three years are allowed to take it | Hope to make it required | I do | |
| Very little time given because we are only a two-year medical school | Yes | No | |

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De partment? | Is the teaching : is it given partment or Si |
|--|--|---------------|--------|--------|--|---|--|
| | Fresh man | Sopho more | Junior | Senior | | | |
| University of Cincinnati College of Medicine, Cincinnati, Ohio | 0 | 0 | 0 | 16 | Yes | Prof of Radiology | Separate |
| Western Reserve School of Medi cine, Cleveland, Ohio | 0 | 0 | 16 | 0 | No | Asst. Prof | With su |
| Ohio State University College of Medicine, Columbus, Ohio | | | | | No | | With sur |
| University of Oklahoma School of Medicine, Oklahoma City, Okla | 0 | 0 | 0 | 18 | Yes | Assoc. Prof of Radiology | See rema |
| University of Oregon Medical School, Portland, Ore. | 0 | 0 | 33 | 0 | Yes | Clin Assoc. in Radiology | With med |
| Hahnemann Medical College of Philadelphia, Philadelphia, Pa. | 4 | 4 | 32 | 6 | Yes | Prof | Medical & therapeutic |
| Jefferson Medical College of Philadelphia, Philadelphia, Pa | 2 C | 0 | 20 | 6 C | Yes | Prof of Roentgenology | Separate |
| Temple University School of Medicine, Philadelphia, Pa. | | | | | Yes | | |
| University of Pennsylvania School of Medicine, Philadelphia, Pa | 0 | 0 | 16 | 0 | Yes | Prof | Separate |
| Women's Medical College of Pennsylvania, Philadelphia, Pa. | 0 | 8 | 0 | 15 | Yes | Clin. Prof of Radiology | Separate |
| University of Pittsburgh School of Medicine, Pittsburgh, Pa | 0 | 0 | 8 | 16 | Yes | Prof of Roentgenology | Separate |
| University of So Dakota School of Medicine, Vermilion, S D | 0 | 0 | | | | | |
| University of Tennessee School of Medicine, Memphis, Tenn | 0 | 0 | 22 | 0 | Yes | Assoc. Prof | Separate |
| Meharry Medical College, Nash ville, Tenn | 0 | 0 | 0 | 32 | Yes | | Separate |
| Vanderbilt University School of Medicine, Nashville, Tenn | 2 | 0 | 72 | 84 | No | Asst Prof Clinical Surgery | Separate le |
| Baylor University College of Medicine, Dallas, Texas | 0 | 0 | 0 | 32 | No | | With surge |
| University of Texas School of Medicine, Galveston, Texas | | | | | Yes | Assoc. Prof | Separate |
| University of Utah School of Medicine, Salt Lake City, Utah | 0 | 11 | 0 | 0 | No | | |

C = clinical

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology and ophthalmology? | Remarks | |
|---|--|---|---|--|
| | | | | |
| Minor special subject | No | No | | |
| Of great importance, but we are not trying to train undergraduates to be practical radiologists | No | Dealt with here departmentally like specialties | | |
| Minor department | No | About the same | | |
| | | | Gives only the first two years of the medical course. | |
| As important as that of any other specialty | Yes | Yes | Seniors get group teaching and also optional seminar in radiology | |
| An important factor in diagnosis and same in treatment | Hard to find more time | All of these subjects are post-graduate, except a general knowledge | | |
| Considerable importance | Only in accordance with needs of other subjects | Almost, as undergraduate subject | | |
| Not a major subject as yet | Yes | Its importance is stressed in all courses | | |
| Of much importance | No | No | The lectures are supplemented by individual instruction in X-ray rooms | |
| Very important | No | Yes | | |
| A minor course | | | | |
| Elementary course highly important | | No | | |
| Important for training specialists in graduate work and students in reading fluoroscopic films and plates | | No | In Junior year, 5 demonstrations are given, in the fifth year, 10 practical demonstrations and 10 lectures and slides | |
| A separate and serious element. | | | In first and second years, 20 hours didactic and 40 hours laboratory work given in physiotherapy, in fourth year, 10 lectures in physiotherapy, in fifth year, series of lectures with demonstrations in radium and X-ray therapy | |
| Of general information without specializing of the student | Only as general information | No | | |
| | | | Gives only the first two years of the medical course | |

| School and Location (Alphabetical by States) | How many hours of didactic lectures are given in the following classes? | | | | Have you a Department of Radiology? | What title is given to the Head of the Radiological De- partment? | Is the radiological teaching separate, or is it given in the De- partment of Medicine or Surgery? |
|---|--|----------------|-------------|------------------------------|--|--|---|
| | Fresh man | Sopho- more | Junior | Senior | | | |
| University of Vermont College of Medicine, Burlington, Vt. | 0 | 16 | 16 | 16 | No | | With medicine and surgery |
| University of Virginia Medical Department, Charlottesville, Va | 0 | 0 | 0 | 20 | Yes | Assoc. Prof of Roentgenology | Separate |
| Medical College of Virginia, Richmond, Va | 0 | 0 | 16 | 16 | Yes | Prof | Separate |
| West Virginia University School of Medicine, Morgantown, W Va | | | | | | | |
| University of Wisconsin Medical School, Madison, Wis | 0 | 0 | 16 | Elective 10 C | Yes | Prof of Radiology | Separate |
| Marquette University School of Medicine, Milwaukee, Wis | 0 | 0 | 16 | 16 | No | Assoc. Clin. Prof and Director of Division of Roentgenology | With surgery |
| CANADA | | | | | | | |
| University of Alberta, Edmonton, Canada | 0 | 0 | 15 | 0 | Sub Dept. | Lecturer in Radiology | With medicine and surgery |
| University of Manitoba, Winnipeg, Canada | 0 | 0 | 0 | 0 | Sub Dept. | Lecturer | With medicine |
| Dalhousie University, Halifax, Nova Scotia | 0 | 0 | 4 | 0 | No | | With medicine |
| Queen's University, Kingston, Ontario, Canada | 0 | 30 | 60 | 44 | Yes | Prof | Separate |
| University of Western Ontario Medical School, London, Ontario, Canada | 0 | 0 | 30 | 15 | Yes | Prof | Separate |
| University of Toronto, Toronto, Ontario, Canada | 0 | 0 | 5th year 15 | 6th year 40 | Yes | Assoc. in Radiology | Separate and in both |
| McGill University, Montreal, Quebec, Canada | 0 | 0 | 5 C | 10 5th year 10 10 C | Yes | Lecturer | Both |
| University of Montreal Medical Faculty, Montreal, Canada | | | | | | | |
| Laval University Faculty of Medicine, Quebec, Canada | 0 | 0 | 0 | 20 | No | | Separate |
| University of Saskatchewan, Saskatoon, Canada | | | | | | | |

| Of what importance is the teaching of radiology considered in your school? | Do you believe that more time should be given to radiology in medical schools? | Do you consider radiology of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology? | Remarks |
|---|--|--|---|
| Minor special subject | No | No | |
| Of great importance, but we are not trying to train undergraduates to be practical radiologists | No | Dealt with here departmentally like specialties | |
| Minor department | No | About the same | |
| | | | Gives only the first two years of the medical course |
| As important as that of any other specialty | Yes | Yes | Seniors get group teaching and also optional seminar in radiology |
| An important factor in diagnosis and same in treatment | Hard to find more time | All of these subjects are post-graduate, except a general knowledge | |
| Considerable importance | Only in accordance with needs of other subjects | Almost, as undergraduate subject | |
| Not a major subject as yet | Yes | Its importance is stressed in all courses | |
| Of much importance | No | No | The lectures are supplemented by individual instruction in X-ray rooms |
| Very important | No | Yes | |
| A minor course | | | |
| Elementary course highly important | | No | |
| Important for training specialists in graduate work and students in reading fluoroscopic films and plates | | No | In Junior year, 5 demonstrations are given, in the fifth year, 10 practical demonstrations and 10 lectures and slides |
| A separate and serious element. | | | In first and second years, 20 hours didactic and 40 hours laboratory work given in physiotherapy, in fourth year, 10 lectures in physiotherapy, in fifth year, series of lectures with demonstrations in radium and X-ray therapy |
| Of general information without specializing of the student | Only as general information | No | |
| | | | Gives only the first two years of the medical course. |

TABLE II—QUESTION 1

TABLE III—QUESTION 1

TABLE IV—QUESTION 1

| Schools giving lectures required | | | | | | Required number hours lectures | | | Required number hours, average each school | | | Required lectures average of all schools replying to questionnaire Hours | | | |
|----------------------------------|---|--------|------------|----|----|--------------------------------|------|------|--|--------|------|--|------|--------|------|
| Number | | | Percentage | | | | | | | | | | | | |
| U | S | Canada | Both | U | S | Canada | Both | U | S | Canada | Both | U | S | Canada | Both |
| 6 | 0 | 6 | 9 | 0 | 8 | 20 | 0 | 20 | 33 | 0 | 33 | 3 | 0 | .2 | |
| 10 | 1 | 11 | 16 | 12 | 15 | 95 | 30 | 125 | 9.5 | 30 | 11.3 | 1.5 | 37 | 1.0 | |
| 40 | 4 | 44 | 72 | 50 | 69 | 877 | 109 | 986 | 21.9 | 27.2 | 22.4 | 15.9 | 13.6 | 15.6 | |
| 29 | 4 | 33 | 50 | 50 | 50 | 670 | 89 | 759 | 23.1 | 22.2 | 23.0 | 11.5 | 11.1 | 11.5 | |
| | 2 | | | 25 | | | 25 | | | 12.5 | | | 3.1 | | |
| | 1 | | | 12 | | | 40 | | | 40 | | | 5 | | |
| | | | | | | 1662 | 228 | 1890 | | | | | | | |
| | | | | | | 293 | 1955 | | | | | | | | |

(7 2-year schools)

| Required clinic demonstration Average of all schools replying to questionnaire Hours | | | Elective lectures Number of schools | | | Elective lectures, percentage of schools | | Elective lectures number of hours | | Average number hours elective lectures | | Average number hours elective all schools | |
|---|----|--------|--|---|------|--|------|--|-----|---|----|--|----|
| U | S | Canada | U | S | Both | U | S | U | S | U | S | U | S |
| 03 | 0 | 028 | 1 | 0 | 1 | | 15 | | .. | | .. | | .. |
| 0 | 0 | 0 | 1 | 0 | 1 | | 16 | | .. | | .. | | .. |
| 29 | 6 | 3 | 1 | 0 | 1 | | 18 | | 27 | | 27 | | 48 |
| 18 | 0 | 16 | 6 | 0 | 6 | | 10.3 | | 108 | | 18 | | 18 |
| | 12 | | | | | | | | | 135 | | | |

| Required number of hours Required lectures and demonstrations | | | | | | Average for all schools | | | Schools giving elective lectures and clinic demonstrations | | |
|--|-----|--------|---------|------|------|-------------------------|----|------|---|------------|---|
| Number | | | Average | | | | | | Number | Percentage | |
| U | S | Canada | U | S | Both | U | S | U | S | U | S |
| 22 | 0 | 22 | 31 | 0 | 31 | 3 | 0 | 3 | 1 | 15 | |
| 95 | 30 | 125 | 9.5 | 30 | 11.3 | 15 | 37 | 1.8 | 1 | 15 | |
| 893 | 114 | 1007 | 21 | 22.8 | 21.4 | 16.2 | 14 | 15.9 | 1 | 18 | |
| 774 | 89 | 863 | 22.1 | 22.2 | 24.1 | 13.7 | 11 | 13 | 9 | 15.5 | |

TABLE V—QUESTION 1

| | Number hours all elective courses | Average per school | Average all schools | Schools giving required and elective courses | | | | | |
|-----------|-----------------------------------|--------------------|---------------------|--|--------|------|------------|--------|------|
| | | | | Number | | | Percentage | | |
| | | | | U S | Canada | Both | U S | Canada | Both |
| Freshman | - | -- | - | 8 | 0 | 8 | 12.5 | 0 | 11 |
| Sophomore | -- | --- | - | 11 | 1 | 12 | 17 | 12.5 | 16.9 |
| Junior | 30 | 30 | 5 | 43 | 5 | 48 | 78.1 | 62.5 | 76.1 |
| Senior | 197 | 218 | 30 | 44 | 4 | 48 | 75.8 | 50 | 72.7 |
| 5th year | | | | | | | | | |
| 6th year | | | | | | | | | |
| Total | 227 | 518 | | | | | | | |

TABLE VI—LECTURES, NUMBER OF HOURS, REQUIRED AND ELECTIVE (QUESTION 1)

| | United States | Canada | Both |
|---------------|---------------|--------|-------|
| Freshman | 20 | 0 | 20 |
| Sophomore | 95 | 30 | 125 |
| Junior | 904 | 109 | 1,013 |
| Senior | 778 | 89 | 867 |
| 5th year | 0 | 25 | 25 |
| 6th year | 0 | 40 | 40 |
| Total 4 years | 1,797 | 228 | 2,025 |
| Total 6 years | 1,797 | 293 | 2,090 |

TABLE VII—CLASS DEMONSTRATIONS—NUMBER OF HOURS GIVEN IN BOTH ELECTIVE AND REQUIRED COURSES (QUESTION 1)

| | United States | Canada | Both |
|---------------|---------------|--------|------|
| Freshman | 2 | 0 | 2 |
| Sophomore | 0 | 0 | 0 |
| Junior | 19 | 5 | 24 |
| Senior | 193 | 0 | 193 |
| 5th year | 0 | 10 | 10 |
| 6th year | 0 | 0 | 0 |
| Total 4 years | 214 | 15 | 229 |
| Total 6 years | 214 | 15 | 229 |

claims made for radiology. It would be a most distressing situation if such a condition should apply to the recent graduates of medicine, numbering thousands each year. The future correction of this evil lies in our

TABLE VIII—QUESTION 2 HAVE YOU A DEPARTMENT OF RADIOLOGY?

| | Percentage | |
|---|------------|------|
| <i>United States (71 schools)</i> | | |
| No answer to question | 5 | 70 |
| Yes | 41 | 62.1 |
| No | 25 | 37.9 |
| <i>Canada (10 schools)</i> | | |
| No answer to question | 2 | 20.0 |
| Yes | 4 | 50.0 |
| No | 4 | 50.0 |
| Total—United States and Canada—81 schools | | |
| No answer to question | 7 | 8.6 |
| Yes | 45 | 60.8 |
| No | 28 | 39.2 |

TABLE IX—QUESTION 3 WHAT TITLE IS GIVEN TO THE HEAD OF THE RADIOLOGICAL DEPARTMENT?

| | Percentage | |
|-------------------------|------------|------|
| <i>United States</i> | | |
| Professor | 35 | 63.6 |
| Associate Professor | 14 | 25.4 |
| Assistant Professor | 4 | 7.3 |
| Instructor in Radiology | 1 | 1.8 |
| <i>Canada</i> | | |
| Professor | 2 | 33.3 |
| Lecturer | 3 | 50.0 |
| Associate in Radiology | 1 | 16.6 |
| No answer to question | 4 | 40.0 |

| Hours in all courses | | | | | | Average all schools | | |
|----------------------|--------|------|---------|--------|------|---------------------|--------|------|
| Number | | | Average | | | | | |
| U S | Canada | Both | U S | Canada | Both | U S | Canada | Both |
| 22 | 0 | 22 | 27 | 0 | 27 | 3 | 0 | 3 |
| 95 | 30 | 125 | 86 | 30 | 104 | 15 | 37 | 18 |
| 923 | 114 | 1037 | 214 | 228 | 216 | 16 | 14.2 | 16 |
| 971 | 89 | 1060 | 22 | 22 | 22 | 16.5 | 11.1 | 16 |
| | 35 | 35 | | | | | | |
| | 40 | 40 | | | | | | |
| 2011 | 308 | 2319 | | | | | | |

TABLE X—QUESTION 4 IS THE RADIOLOGICAL TEACHING SEPARATE, OR IS IT GIVEN IN THE DEPARTMENT OF MEDICINE OR SURGERY?

| | | | Per-centage |
|-----------------------------------|----|------|-------------|
| <i>United States (71 schools)</i> | | | |
| No reply to question | 7 | 98 | |
| Number of replies to question | 64 | 90.2 | |
| Teaching separate | 26 | 40.6 | |
| Medicine | 14 | 21.8 | |
| Surgery | 16 | 25.0 | |
| Medicine and surgery | 8 | 12.5 | |
| <i>Canada (10 schools)</i> | | | |
| No reply to question | 2 | 20.0 | |
| Teaching separate | 2 | 25.0 | |
| Medicine | 4 | 50.0 | |
| Surgery | 0 | 0 | |
| Medicine and surgery | 2 | 25.0 | |

medical schools, which have already made substantial advancement in radiologic education

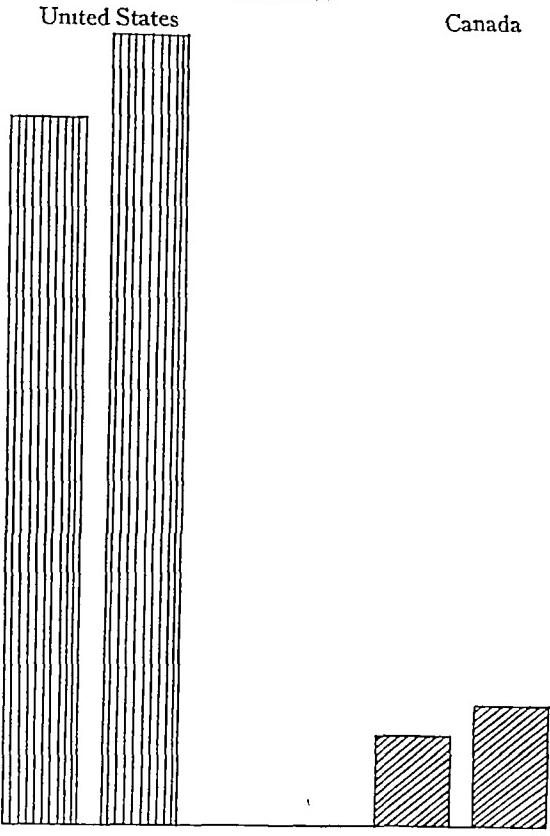
Recent graduates in medicine are well equipped with the medical knowledge and training in technic to practise medicine scientifically. Modern medical schools are usually sufficiently endowed to procure the best medical talent available as teachers, and are adequately equipped with laboratory facilities, all of which contributes to the

TABLE XI—QUESTION 5 OF WHAT IMPORTANCE IS THE TEACHING OF RADIOLOGY CONSIDERED IN YOUR SCHOOL?

| | | | Per-cent-age |
|---------------------------------------|----|------|--------------|
| <i>United States</i> | | | |
| No reply to question | 14 | 19.7 | |
| Number of replies | 57 | 80.3 | |
| Major, considerable, great importance | 50 | 87.7 | |
| Minor department or minor importance | 4 | 7.0 | |
| Elective | 2 | 3.5 | |
| Contributory | 1 | 1.7 | |
| <i>Canada</i> | | | |
| No reply to question | 3 | 30.0 | |
| Number of replies | 7 | 70.0 | |
| Major importance | 5 | 71.4 | |
| Minor importance | 2 | 28.5 | |

education of the modern, scientific, and practical young doctor of to-day. Young doctors appreciate the necessity for years of application and study in order that they may become specialists in any branch of medicine. They are taught how to perform an operation for cataract, and even the enucleation of an eye, yet how many would be brave enough to perform these operations on private patients? They have been taught that such procedures are for the ophthalmologist, who is a specialist with years of

GRAPH I



A—Hours of required and elective lectures given in radiology in schools in U S, 1,797

B—Hours of required and elective lectures and class demonstration given in radiology in schools in U S, 2,011

A'—Hours of required and elective lectures given in radiology in Canadian schools, 228

B'—Hours of required and elective lectures and class demonstration given in radiology in Canadian schools, 308

TABLE XII—QUESTION 6 DO YOU BELIEVE THAT MORE TIME SHOULD BE GIVEN TO RADIOLOGY IN MEDICAL SCHOOLS?

| | Per-centage | |
|----------------------|-------------|------|
| <i>United States</i> | | |
| No reply to question | 16 | 22.8 |
| Number of replies | 54 | 77.2 |
| Yes | 23 | 42.5 |
| No | 31 | 57.5 |
| <i>Canada</i> | | |
| No reply to question | 5 | 50.0 |
| Number of replies | 5 | 50.0 |
| Yes | 3 | 60.0 |
| No | 2 | 40.0 |

TABLE XIII—QUESTION 7 DO YOU CONSIDER RADIOLOGY OF SUFFICIENT IMPORTANCE TO BE RECOGNIZED ON A PARITY WITH OTOLARYNGOLOGY, DERMATOLOGY, AND OPHTHALMOLOGY?

| | Per-centage | |
|----------------------|-------------|------|
| <i>United States</i> | | |
| Number of replies | 55 | 78.6 |
| No reply to question | 15 | 21.4 |
| Yes | 40 | 72.7 |
| No | 15 | 27.3 |
| <i>Canada</i> | | |
| Number of replies | 6 | 60.0 |
| No reply to question | 4 | 40.0 |
| Yes | 2 | 33.3 |
| No | 4 | 66.6 |

experience in eye diseases. A substantial course in radiology in our medical schools would have a like influence on students as in the instance just mentioned, and few would venture in the realm of radiology without sufficient knowledge and experience.

Radiologists have often wondered if the medical schools of this country are giving sufficient time to the teaching of radiology, so that their graduates will have acquired at least an intelligent and practical understanding of this subject.

While we have known for some time that certain schools were teaching students radiology, few of us knew the amount of time consumed and the different methods used. Very little information is available in this regard. Personally, I have known for some time that certain of our schools were giving a more substantial course in radiology than most of us thought. My attention was first attracted to this when, as a member of my State Board, I was asking questions pertaining to radiology. The answers received from the recent graduates indicated that, on the whole, they had an intelligent understanding of the application of the roentgen ray and radium, so much so, in fact, that I thought that more radiologic questions

should be asked by the various State Boards of Medical Examiners. But before agitating this question, I decided to ascertain the status of radiologic teaching in various medical schools. For this reason the following seven questions were sent each medical school of this country and Canada:

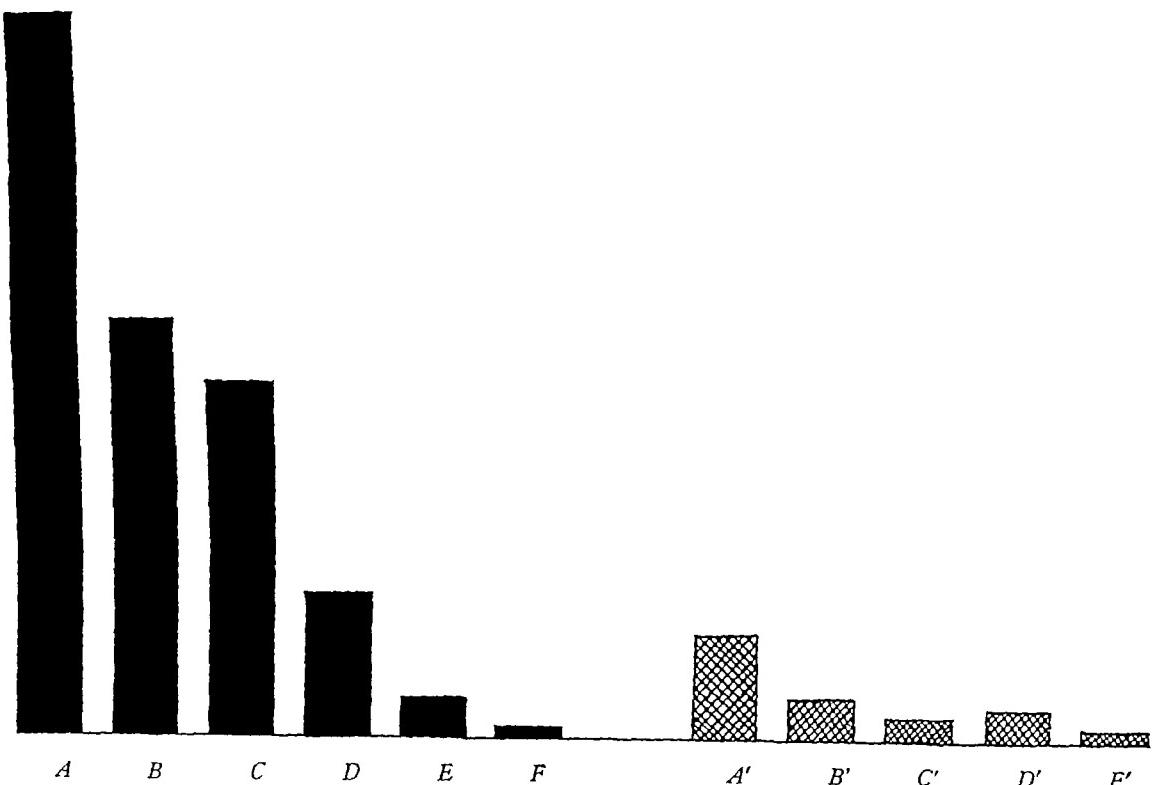
- 1 How many hours of didactic lectures are given in the following classes Freshman, Sophomore, Junior, Senior?
- 2 Have you a Department of Radiology?

- 3 What title is given to the head of the Radiologic Department?
- 4 Is the radiologic teaching separate, or is it given in the Department of Medicine or Surgery?
- 5 Of what importance is the teaching of radiology considered in your school?
- 6 Do you believe that more time should be given to radiology in medical schools?
- 7 Do you consider radiology of sufficient

GRAPH II

United States

Canada



A—71 medical schools in U S

B—41 medical schools in U S have a Department of Radiology

C—in 35 medical schools in U S the title of the Head of the Radiological Department is Professor

D—in 14 medical schools in U S the title of the Head of the Radiological Department is Associate Professor

E—in 4 medical schools in U S the title of the Head of the Radiological Department is Assistant Professor

F—in 1 medical school in U S the title of the Head of the Radiological Department is Instructor in Radiology

A'—10 Canadian medical schools

B'—4 Canadian medical schools have a Department of Radiology

C—in 2 Canadian medical schools the title of the Head of the Radiological Department is Professor

D'—in 3 Canadian medical schools the title of the Head of the Radiological Department is Associate Professor

E'—in 1 Canadian medical school the title of the Head of the Radiological Department is Lecturer in Radiology

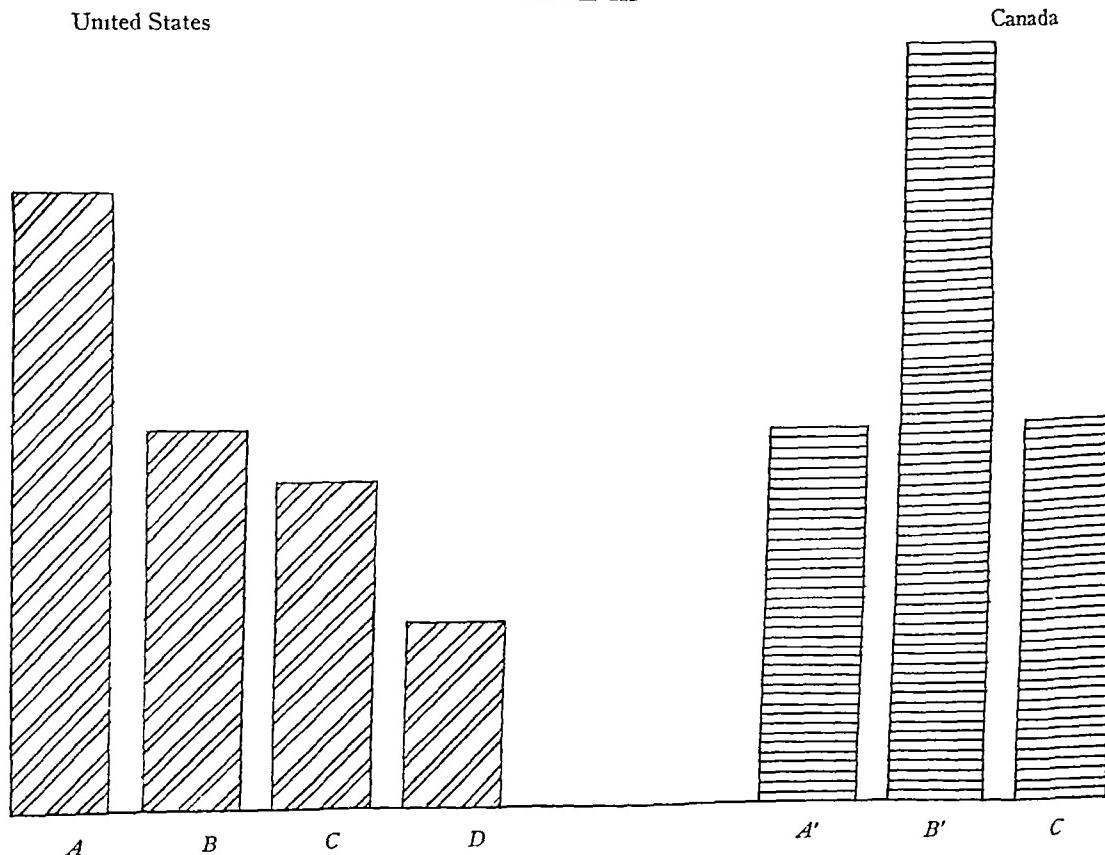
importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology?

The replies have been tabulated (Tables I-XIII) so that the information may appear in concise form, easy of analysis. Thirteen tables are presented, comprising the essential information derived from the questionnaire.

Table I presents the names of the different medical schools of the United States and Canada and their replies. Table II shows the number of schools which do not give lectures on radiology or clinic demonstrations, etc., the number which did not reply to Question 1, the number in which lectures

are required, the number of hours of radiologic lectures, and the hours per school. Table III presents the number of schools in which clinic and class demonstrations are required, the hours allotted to each, an average of those requiring clinic demonstrations, and the number of hours of elective lectures. Table IV presents the number of schools and hours given to elective clinic demonstrations and to the required courses in lectures and demonstrations, also the number of schools giving elective lectures and clinic demonstrations. Table V lists the number of hours of required and elective lectures, Table VI the number of hours of

GRAPH III

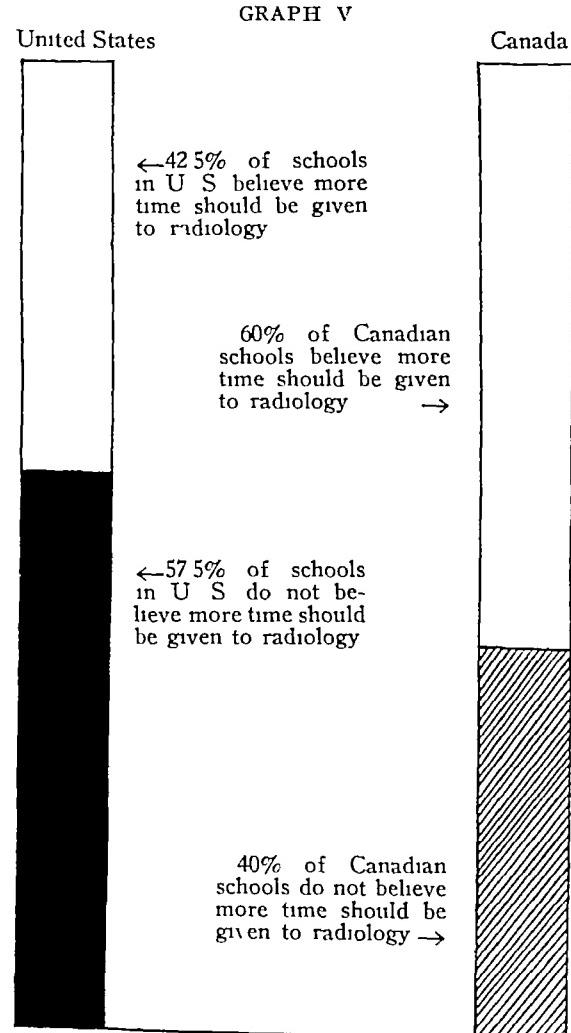
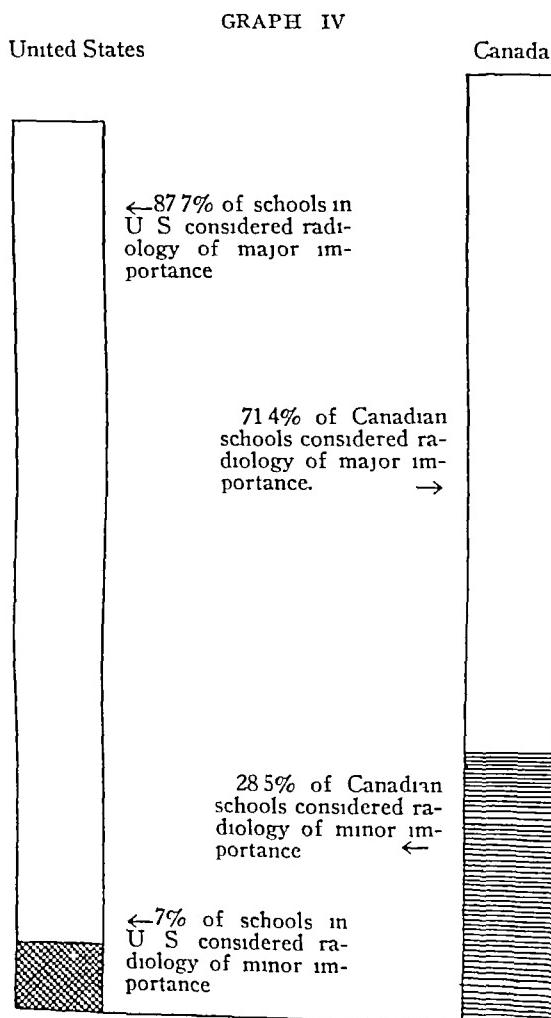


- A—40.6% of schools in U. S. give separate radiological teaching.
B—25% of schools in U. S. teach radiology in the Department of Surgery.
C—21.8% of schools in U. S. teach radiology in the Department of Medicine.
D—12.5% of schools in U. S. teach radiology in the Departments of Medicine and Surgery.
A'—25% of Canadian schools give separate radiological teaching.
B'—50% of Canadian schools teach radiology in the Department of Medicine.
C'—25% of Canadian schools teach radiology in the Departments of Medicine and Surgery.

required and elective class demonstrations Table VII shows the number of hours given in all elective courses, also the number of schools and hours giving required and elective courses Tables VIII-XIII tabulate the replies to Questions 2-7 in percentages Each of the 71 recognized medical schools of the United States and 10 Canadian schools answered the questionnaire They did not, however, answer every question The two-year schools answered only Question 1 Some of the answers to Question 1 are in Table II, the others are in Table VIII (See also Graphs I-VI)

In the Freshman year, six medical schools of this country give 20 hours, or 33 hours per school, to required radiologic lectures,

in the Sophomore year, 10 schools give 95 hours, or 9.5 hours per school, in the Junior year, 40 schools give 877 hours, or 21.9 hours per school, and in the Senior year, 29 schools give 670 hours, or 23.1 hours per school The Canadian schools do not give lectures in radiology in the Freshman year One school gives 30 hours in the Sophomore year, 4 schools give 109 hours, or 27.2 hours per school, in the Junior year, and 4 schools give 89 hours, or 22.2 hours per school, in the Senior year Besides this, two Canadian schools give 25 hours, or 12.5 hours per school, in the fifth year, and one school gives 40 hours in the sixth year The total number of hours given to required radiologic lectures in the medical schools of

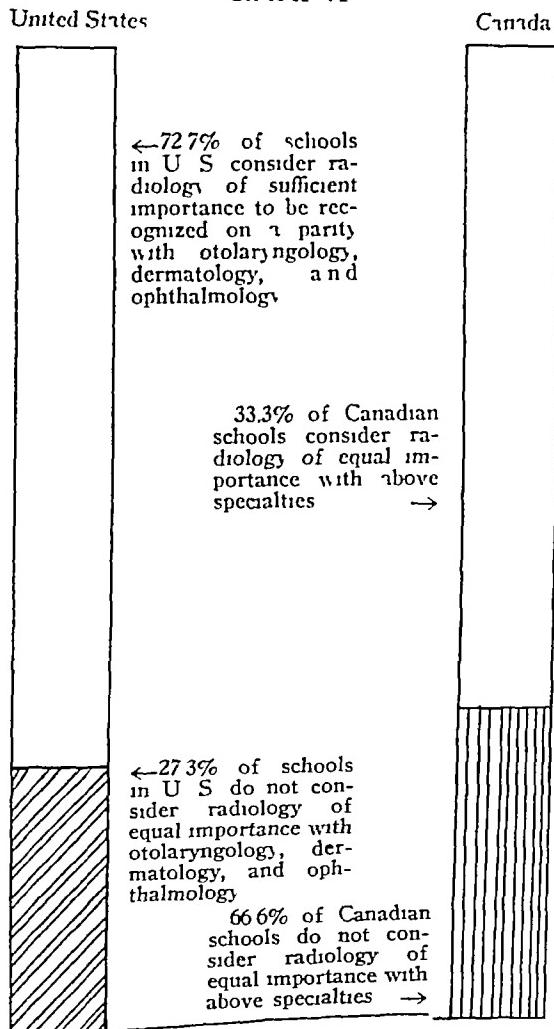


the United States is 1,662, in Canada, 293, which includes the fifth and sixth years. This makes a total for both countries of 1,955 hours (See Graph I.)

Many different answers were received to Question 1. The answers appertaining to didactic lectures have already been tabulated. Those answering that they gave, in addition, required class and clinic demonstrations are found tabulated in Tables III and IV. Table V is a summary of Tables II, III, and IV. In Table V we find that 8 of our schools, or 12.5 per cent, gave required and elective courses in the Freshman year, 11, or 17 per cent, in the Sophomore

year, 43, or 78.1 per cent, in the Junior year, and 44, or 75.8 per cent, in the Senior year. One school in Canada, or 12.5 per cent, gave required and elective courses in the Sophomore year, five schools, or 62.5 per cent, in the Junior year, and four, or 50 per cent, in the Senior year. The courses of required and elective periods in our Freshman year consisted of 22 hours, or 27 hours per school, 95 hours, or 8.6 hours per school, in the Sophomore year, 923 hours, or 21.4 hours per school, in the Junior year, and 971, or 22 hours per school, in the Senior year. In Canada none was given in the Freshman class, 30 hours per school in the Sophomore year, 114 hours, or 22.8 hours per school, in the Junior year, and 89, or 22 hours per school, in the Senior year. The total number of hours given in all elective courses in our medical schools is 227, or 21.8 hours for each school. The total hours devoted to radiologic teaching in schools in the United States is 2,011. In Canadian schools it is 308, a grand total of 2,319.

GRAPH VI



Question 2 (Table VIII) was answered by 66 of our schools. Of these, 41, or 62.1 per cent, stated they have a Department of Radiology, 25, or 37.9 per cent, do not. Of the Canadian schools, 8 answered the question, 4, or 50 per cent, have a Department of Radiology and 4, or 50 per cent, do not. In the United States and Canada, 60.8 per cent of the schools maintain Departments of Radiology and 39.2 per cent do not (See Graph II.)

Question 3 (Table IX) was answered by 54 of the schools in the United States and 6 in Canada. Of medical schools in the United States, 35, or 63.6 per cent, have Professors of Radiology, 14, or 25.4 per cent, Associate Professors, 4, or 7.3 per cent, have Assistant Professors, and 1, or 1.8 per cent, has Instructors. In Canada, 2 schools, or 33.3 per cent, have Professors, 3, or 50 per cent, have Lecturers, and 1 school, or

16.6 per cent, has an Associate in Radiology (See Graph II)

Question 4 (Table X) was answered by 64 American schools and 8 Canadian schools. Of these, 26, or 40.6 per cent, stated that radiology is being taught as a separate branch in the United States, 14, or 21.8 per cent, that it is being taught in the Department of Medicine, 16, or 25 per cent, in the Department of Surgery, and 8, or 12.5 per cent, in both Medicine and Surgery. In Canada, 2, or 25 per cent, teach radiology separately, 4, or 50 per cent, in the Department of Medicine, and 2, or 25 per cent, in both Surgery and Medicine (See Graph III).

Question 5 (Table XI) was answered by 57 American schools and 7 Canadian schools. In the United States, 50, or 87.7 per cent, consider the teaching of radiology as of major, considerable, or great importance, 4, or 7 per cent, consider the teaching of radiology as a minor department or of minor importance, 2, or 3.5 per cent, consider it as elective, and 1, or 1.7 per cent,

as contributory. In Canada, 5, or 71.4 per cent, of the schools consider it as of major importance, and 2, or 28.5 per cent, consider it as of minor importance (See Graph IV).

Question 6 (Table XII) was answered by 54 schools in the United States and 5 in Canada. In the United States, 23, or 42.5 per cent, believe that more time should be given to radiology in medical schools, and 31, or 57.5 per cent, did not so believe. In Canadian schools, 3, or 60 per cent, believe that more time should be given to it, and 2, or 40 per cent, did not so believe (See Graph V).

Question 7 (Table XIII) was answered by 55 American and 6 Canadian schools. In the United States, 40, or 72.7 per cent, thought that radiology is of sufficient importance to be recognized on a parity with otolaryngology, dermatology, and ophthalmology, and 15, or 27.3 per cent, did not so believe. 2, or 33.3 per cent, of the Canadian schools believe it to be so, and 4, or 66.6 per cent, do not agree (See Graph VI).

World-wide Study of Cosmic Rays Begun
—A world-wide campaign for more knowledge about the little-understood cosmic radiation, whose rays are the most penetrating known, was begun when Dr Arthur H. Compton, of the University of Chicago, noted physicist, left for Panama to start the first investigations.

In Panama Dr Compton will climb Mt. Chico to measure the rays with a new instrument. He will then go to Huancayo in Peru, Mt. Cook in New Zealand, Mt. Kosciusko in

Australia, Mauna Loa in Hawaii, and Mt. McKinley in Alaska. Mrs. Compton and a fourteen-year-old son, Arthur Alan, will accompany him on this trip around the world.

When Dr. Compton returns next summer he will hear reports from three other parties, one of which will work in Patagonia and Chile, the second in South Africa, and the third in India, Ceylon, Straits Settlements, and Java. It is expected that tests at altitudes of 20,000 feet and higher will be made. Negotiations are also under way for observations in the polar regions.—*Science Service*

RADIOLOGIC SERVICE IN THE UNITED STATES¹

REPORT BY THE COUNCIL ON MEDICAL EDUCATION AND HOSPITALS

The work of preparing a list of acceptable "radiologic laboratories and departments of radiology" was assigned to the Council on Medical Education and Hospitals by the House of Delegates at the Minneapolis session in 1928. The "Essentials" were prepared by the Council in collaboration with a large number of specialists in the field of radiology. Suitable questionnaires were prepared in the same manner and were mailed to all the physicians who were known to be engaged in the practice of radiology and roentgenology. The majority of the physicians so engaged returned their questionnaires and they were considered for the list. To assist the Council in preparing the list, the officials of the two leading radiologic societies co-operated with the Council's special committee by appointing qualified radiologists in all parts of the country to act as advisers. These advisers, numbering 198, examined the credentials of applicants from their respective localities, made inspections, and advised which candidates could qualify, according to the "Essentials." The resulting tentative list, together with a detailed report on the survey, was published in the Radiologic Number of *The Journal*, May 23, 1931.

Since various branches of medicine look to the radiologist for important aid in diagnosis and treatment, the careful certification of physicians qualified in radiology should be made to protect the patient and the profession. A powerful influence in the regulation of those qualified is, of course, membership in special radiologic societies. This membership immediately bars the lay practitioner and, to some extent, the physician who has not had adequate training and experience. Membership lists of the special

societies include the names of many whose main interest lies in other specialties.

The Council has understood from the beginning and has advocated the principle that the practice of radiology is the practice of medicine. It has followed this principle in the interpretation of the essentials, in the preparation of its lists and in every opportunity that the Council has had to express itself on this point to the entire medical profession.

EMPHASIS PLACED ON SPECIALISTS

At first the emphasis was on laboratories and departments of radiology and roentgenology. Both the questionnaire and the "Essentials" laid stress on the laboratories, including equipment, personnel, records and publicity. The tentative list referred to laboratories or departments of radiology and roentgenology. But difficulties were found in the listing of laboratories as such, because laboratories change names, they also change directors and ownership, these changes often resulting in an entire change of methods and sometimes a reversal of ethical principles. It became apparent that the determining factor in radiologic service is the specialist who does the work or supervises it. Emphasis therefore, was shifted from the laboratory to the directing radiologist, the main emphasis now being placed on his qualifications.

The "Essentials" have been recently revised to correspond with this new point of view, and the newly revised "Essentials," as adopted by the Council at its meeting in February, 1932, are printed in connection with this article.

HOW THE LIST IS COMPILED

The routine by which all applicants are admitted to the list is as follows:

¹Reprinted by permission from the *Journal of the American Medical Association* March 19 1932 XCVIII

1 A questionnaire is sent to all specialists in the field who, according to information, seem to have the necessary qualifications

2 On receipt of the returned questionnaire, the record and credentials of the applicant are verified in the biographic file of the American Medical Association

3 Each application is submitted to at least three or more advisers, who give their estimate and opinion of the qualifications of the applicant, based on personal knowledge or inspection, or both

4 Membership in special societies is looked up, and the advice of the officers of those societies and the officers of county medical societies, and of councilors, is obtained

In this way the principle is observed that specialists should be judged by specialists. Those who work and associate with specialists have the best opportunity of knowing them. Due attention is also given to the records in the biographic file of the American Medical Association and to the individual's own report on himself and his work.

The first survey covered mainly those radiologists who were conducting laboratories of their own and included, also, those who were connected with hospitals, but did not include others, such as those who teach and supervise radiologic work in medical schools and those working in research institutions and government departments. More recently, the work has been extended to all of these fields. Questionnaires have recently been sent out and applications received from thirty-two of these specialists who were not included in the first survey. There has not been time to give to all the later applications the consideration that is due them, which will explain the omission of some from the list contained in the accompanying pages.

Additions and revisions will be made from time to time, suggestions for changes will be received and consideration of new applications will go on continuously. Co-

operation by the men in the specialty has been excellent and must continue in order that the work may be of optimum value.

PATHOLOGISTS AND CLINICAL PATHOLOGISTS

The list of clinical pathologists which accompanied the list of radiologists in the Radiologic Number for May 23, 1931, is not included in the present issue but is being revised for a later issue of *The Journal*. This will give the necessary time for a thorough revision of that list, including a classification of pathologists and clinical pathologists so as to form a more accurate and a more useful list. Also, the pathologists and clinical pathologists connected with medical colleges, research institutions and government departments will be included, as is being done in the case of the radiologists.

ESSENTIALS FOR ADMISSION TO LIST OF PHYSICIANS SPECIALIZING IN RADIOLOGY

Physicians Eligible

Consideration for admission to the list is open to all regular licensed physicians engaged in radiologic work in accordance with the essentials, whether connected with a hospital or conducting an independent laboratory.

1 Qualifications

(a) The candidate shall be a graduate of a medical school that is approved by the Council on Medical Education and Hospitals and shall be licensed to practise medicine in the State in which his department is located. He shall also have had special training, such as is approved by the Council, in radiology, roentgenology or radium therapy at an acceptable school—preceptorship, hospital or clinic, department of radiology, roentgenology or radium therapy—for a period of at least three years, or, in lieu of such training, shall have had a minimum of five years' experience in the exclusive practice of radiology, roentgenology or radium therapy. He must be a man of good standing in the medical profession, and particularly among those specializing in radiology. He shall be a member of the Ameri-

basis or have definite hours of attendance at the department, such hours to be ample to insure the element of medical consultation in every examination or treatment

(b) The department shall be under the direction of a physician radiologist, roentgenologist or radium therapist, as the circumstances may require. The director shall be responsible for all examinations and treatments. He shall be responsible for all professional assistants and for the efficient maintenance of the department.

Physicians employed by laboratories which are under lay control and direction will not be eligible for consideration for this listing.

(c) Assistants—The director may have a corps of qualified medical and technical assistants responsible to him, and for whom he is responsible, to carry out accurately the various functions of the department.

2 Definitions

Radiology—The branch of medicine which deals with the diagnostic and therapeutic application of radiant energy, including roentgen rays, radium, ultra-violet rays and other spectral radiation.

Department of Radiology—A private laboratory or department of a hospital, clinic or other institution, organized and equipped for the diagnostic and therapeutic application of radiant energy, including roentgen rays, radium, ultra-violet rays and other spectral radiation.

Radiologist—A qualified physician who also has obtained adequate special training and experience in general radiology.

Roentgenology—The phase of radiology which deals with the diagnostic and therapeutic application of roentgen rays only.

Department of Roentgenology—A private laboratory or department of a hospital, clinic or other institution organized and equipped for the diagnostic and therapeutic application of roentgen rays only. A department organized and equipped solely for the diagnostic or therapeutic application of roentgen rays shall be known as a department of diagnostic or therapeutic roentgenology, respectively.

Roentgenologist—A qualified physician who

has had adequate training and experience in the diagnostic and therapeutic application of roentgen rays.

Diagnostic Roentgenologist—A roentgenologist who limits his practice to the diagnostic phase of roentgenology.

Therapeutic Roentgenologist—A roentgenologist who limits his practice to the therapeutic phase of roentgenology.

Radium Specialist—A physician who has had adequate training and experience in the therapeutic use of radium and who specializes in this work.

3 Scope

A department of radiology should be able to render all of the following services:

(a) Roentgenography, simple or stereoscopic, of any part of the body, with medical interpretation of the roentgenographic observations and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

(b) Roentgenoscopy of any part of the body, in any position, with or without opaque media, with medical interpretation of the roentgenoscopic observations, and under satisfactory conditions for the protection of the patient and the professional and technical personnel.

(c) Roentgenotherapy of all benign and malignant diseases amenable to such treatment with roentgen rays generated at low, moderate or high voltage (long, medium or short wave length), as the conditions may require, and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

(d) Radium therapy of all benign and malignant diseases amenable to such treatment with an adequate quantity of radium element or emanation, and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

Ultra-violet therapy, general or local, with satisfactory air-cooled and water-cooled quartz mercury lamps or carbon arc lamps, with suitable quartz and other applicators for irradiation of cavities, sinuses or the superficial lesions under pressure, and under satisfactorily

conditions for the protection of the patient and of the professional or technical personnel This stipulation is not mandatory, but the Council recommends that every department of radiology be equipped for ultra-violet therapy or that the ultra-violet equipment of hospitals be placed in the department of radiology Ultra-violet treatment by the department of physical therapy shall not be countenanced unless such department is under the control and supervision of a medical director who has specialized in radiology

A department of roentgenology should be able to render the services specified under *a*, *b* and *c*

A department of diagnostic roentgenology should be able to render the services specified under *a* and *b*

A department of therapeutic roentgenology should be able to render the services specified under *c*

A department of radium therapy should be able to render the services specified in *d*

4 Housing

The housing should be adequate for the proper functioning of the department of radiology or roentgenology Damp or ill ventilated quarters are unsuitable for such work

5 Equipment

The equipment should be sufficient to carry out properly the technical procedures and activities of the department of radiology, roentgenology or radium therapy

6 Protection

The arrangement of working rooms and conditions, and the construction of all apparatus shall be such as to provide adequate protection, both from electrical shock and from avoidable exposure to roentgen rays or radium, to patients, attendants, and other persons in or near the department The requirements in this respect are based on the recommendations adopted by the International Congress of Radiology, held at Stockholm, Sweden, in July, 1928, and approved by the American Roentgen Ray Society and the Radiological Society of North America

7 Records

Full records of all examinations and treatments made by the department, suitably indexed, are essential Roentgenograms made in the department should have inerasible identification marks which will preclude error as to patients concerned Roentgenograms may be lent to referring physicians but should be returned to the laboratory for filing and future reference Suitable storage facilities should be provided where roentgenograms and other records will be both safe and readily available for reference They shall be kept as long as there is the possibility of their being needed for the benefit of the patients or their physicians

As roentgenography constitutes only a kind of medical examination, on which the roentgenologist's opinion of the patient's condition is partly or wholly based, and as the opinion of the specialist is the essential factor, the Council holds that the introduction of roentgenograms as evidence in medico-legal cases should be discouraged as immaterial and as tending to adulterate the process of justice There is no more reason for the introduction of roentgenograms than for requiring a pathologist to bring to court his microscope and his sections of tissues

8 Reports

The reports of a department of radiology, roentgenology or radium therapy shall be made through the director on stationery or blanks having the name of the director printed thereon Under no circumstances shall roentgenologic diagnoses, interpretations, opinions statements of prognosis, or therapeutic suggestions be offered by the non-medical personnel

9 Library

The department of radiology, roentgenology, or radium therapy should be provided with, or have convenient access to, a library including current scientific books and journals on all the various subjects required in its work

basis or have definite hours of attendance at the department, such hours to be ample to insure the element of medical consultation in every examination or treatment

(b) The department shall be under the direction of a physician radiologist, roentgenologist or radium therapist, as the circumstances may require. The director shall be responsible for all examinations and treatments. He shall be responsible for all professional assistants and for the efficient maintenance of the department.

Physicians employed by laboratories which are under lay control and direction will not be eligible for consideration for this listing.

(c) *Assistants*—The director may have a corps of qualified medical and technical assistants responsible to him, and for whom he is responsible, to carry out accurately the various functions of the department.

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Roentgenologist—A qualified physician who

has had adequate training and experience in the diagnostic and therapeutic application of roentgen rays.

Diagnostic Roentgenologist—A roentgenologist who limits his practice to the diagnostic phase of roentgenology.

Therapeutic Roentgenologist—A roentgenologist who limits his practice to the therapeutic phase of roentgenology.

Radium Specialist—A physician who has had adequate training and experience in the therapeutic use of radium and who specializes in this work.

3 Scope

A department of radiology should be able to render all of the following services:

(a) Roentgenography, simple or stereoscopic, of any part of the body, with medical interpretation of the roentgenographic observations and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

(b) Roentgenoscopy of any part of the body, in any position, with or without opaque media, with medical interpretation of the roentgenoscopic observations, and under satisfactory conditions for the protection of the patient and the professional and technical personnel.

(c) Roentgenotherapy of all benign and malignant diseases amenable to such treatment with roentgen rays generated at low, moderate or high voltage (long, medium or short wave length), as the conditions may require, and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

(d) Radium therapy of all benign and malignant diseases amenable to such treatment with an adequate quantity of radium element or emanation, and under satisfactory conditions for the protection of the patient and of the professional and technical personnel.

Ultra-violet therapy, general or local, with satisfactory air-cooled and water-cooled quartz mercury lamps or carbon arc lamps, with suitable quartz and other applicators for irradiation of cavities, sinuses or the superficial lesions under pressure, and under satisfactory

10 Ethics, Fees and Publicity

Radiology is a special type of medical practice, and the physician practising radiology is subject to the same rules of special training and conduct that govern his fellow specialists in the practice of medicine and surgery. The Principles of Medical Ethics of the American Medical Association shall apply in all cases. The fees charged for radiologic services shall be under the control of the director of the department. All systems of rebates, discounts, special group rates, etc., shall be considered unethical, except that, in cases in which the patient's economic status is the determining factor, the radiologist, like his fellow physician in medicine or surgery, may waive part or all of the fee.

The publicity of a department of radiology, roentgenology or radium therapy should be in professional good taste and limited to statements of fact as to name, address and telephone number, names and titles of the director and other active responsible personnel, field of work covered, office hours, directions for referring patients, and so forth. It should not contain misleading statements or claims of unusual superiority. It should not advocate medical fads nor lay undue stress on the importance of roentgenologic observations. On the letterheads or any other form of publicity, only the names of those rendering regular services to the department should appear as being connected with the department. Advertising matter should be directed only to physicians, either through bulletins or through recognized technical journals, and never to the non-professional public, as, for example, by announcements in popular journals and periodicals, circulars, pamphlets or telephone lists.

11 Admission to the Approved List

Only when the physician is the director or is affiliated with a department of radiology, roentgenology or radium therapy in which the personnel, space, equipment, management, finances and records are such as will insure honest, efficient and accurate work may he expect to be listed. Physicians desiring to be considered for the approved list should apply to the Council on Medical Education and Hos-

pitals of the American Medical Association, 535 North Dearborn Street, Chicago

PHYSICIANS SPECIALIZING IN RADIOLOGY—1,003

The list contains the names of only those who responded to the questionnaire, who have been found to comply with the "Essentials," and who were recommended by the advisers for their respective States. Those who are still under consideration, and others who may apply, will, when accepted, be added in subsequent issues of *The Journal*.

The type of service rendered is given opposite the name "Radiology," under "Type of Service," always includes short wave therapy, also known as "deep therapy." The asterisk (*) on "roentgenology" indicates that short wave therapy is included.

Alabama

| Name and Address | Type of Service |
|---|--|
| Anniston Levi, Irwin P., 931 Noble St | Roentgenology |
| Birmingham Barfield Carter M., 2031 1st Ave., N. Edmonson John H., 1928 1st Ave., N. Kemodel Karl F., Medical Arts Bldg. Meadows, James A., 1928 1st Ave., N. | Roentgenology Roentgenology Roentgenology Roentgenology |
| Dothan Ellis John T., 200 E. Main St. | Roentgenology |
| Montgomery Boswell F. P., 201 Montgomery St. | Radiology |

Arizona

| | |
|--|---------------|
| Phoenix Goss H. L., 125 W Monroe St | Roentgenology |
| Watkins W. W., 12 N Central Ave. | Radiology |

Arkansas

| | |
|--|---------------|
| Forth Smith Brooksher W. R., 603 Garrison Ave | Radiology |
| Hot Springs Nims Charles H., 236 Central Ave | Radiology |
| Little Rock Rhinehart B. A., 701 Main St | Roentgenology |
| Rhinehart D. A., 701 Main St | Roentgenology |
| Zell, A. M., 2000 Main St | Radiology |
| Monticello Wilson J. S. | Radiology |

California

| | |
|---|---------------------------|
| Alameda Lum William T., 1361 Park St | Roentgenology* |
| Bakersfield Fox L. H., 2025 18th St | Roentgenology |
| Berkeley Heald E. Schulze 3000 Regent St | Roentgenology |
| Van Nuys, R. G., 2490 Channing Way | Radiology |
| Fresno Broemser, Milton A., 2014 Tulare St | Radiology |
| Misholland, W. G., Bank of America Bldg. | Roentgenology |
| Ruff, Frank R., Burnett Sanatorium | Radiology |
| Glendale Jones, L. L., 229 N Central Ave | Roentgenology* |
| Hollywood Sherman B. H., 6777 Hollywood Blvd. | Roentgenology |
| Stewart, Charles W., 1680 N. Vine St. | Roentgenology |
| Warren, J. W., 1332 N. Vermont Ave | Radiology |
| Livermore Beaudet, E. A., Veterans Administration Hospital | Hospital Diagnostic roent |
| Long Beach Heylmin, M. H., 115 Pine Ave | Diagnostic roent |
| Mayfield, Claude, 115 Pine Ave | Diagnostic roent |
| Los Angeles Bailey Cornelius O., 727 W. 7th St. | Radiology |
| Blaine Edward S., 727 W. 7th St. | Roentgenology |
| Bonoff Karl M., 1930 Wilshire Blvd. | Roentgenology |

RADIOLOGIC SERVICE IN THE UNITED STATES

995

| Name and Address | Type of Service | Name and Address | Type of Service |
|--|-------------------------------|--|--|
| Ottumwa Herrick, John F, 103 S Market St Spilman, H A, 103 S Market St | Radiology Diagnostic roent | Walton, Henry J, 104 W Madison St Waters, Charles A, 1100 N Charles St Wright, Harold E, 101 Read St | Roentgenology Roentgenology Diagnostic roent |
| Kansas | | Crisfield Collins, C. E | Roentgenology |
| Eldorado Dinsmore, W S 324 W Central St | Diagnostic roent | Cumberland Cowherd, F G, 122 S Centre St | Roentgenology |
| Ellsworth Hussem, H Z | Diagnostic roent | Hagerstown Hoffmeier, F N, Washington Co Hosp | Roentgenology |
| Eureka Moore, R. W | Roentgenology | Boston | Massachusetts |
| Fort Scott Prichard, J R, 209 S Main St | Radiology | Blackett, Charles W, 35 Bay State Road Butler, P F, 35 Bay State Road | Roentgenology Radiology |
| Kansas City Allen, Lewis G, 601 Minnesota Ave | Radiology | Coffin, W K, 416 Marlboro St Ellsworth S W, 520 Beacon St | Roentgenology Roentgenology |
| Lawrence Jones, H T, 107 E 8th St | Diagnostic roent | George, Arial W, 43 Bay State Rd Healy, Thomas R, 370 Marlboro St | Roentgenology Roentgenology |
| Salina Brittain, O R, 105 S 7th St | Roentgenology | Holmes, George W, 265 Charles St Leonard, Ralph D, 43 Bay State Rd | Radiology Roentgenology |
| Topeka Finney, Guy A, 901 Kansas Ave | Roentgenology | Liebman, Charles, 311 Commonwealth Ave MacMillan, A S, 483 Beacon St | Roentgenology Roentgenology |
| Floersch, M A, 700 Kansas Ave | Roentgenology | Martin, William C, Mass General Hosp McCarthy, H L, 479 Beacon St | Roentgenology Roentgenology |
| Owen, Arthur K, 901 Kansas Ave | Roentgenology | O'Brien, Frederick W, 465 Beacon St Osgood, Herman A, 144 Commonwealth Ave | Radiology Roentgenology* |
| Wichita Frost, E. J, 227 E Douglas Ave | Radiology | Ott, George J, 344 Commonwealth Ave Perkins, Roy S, 520 Commonwealth Ave | Roentgenology Roentgenology |
| Swope, Opie W, 105 N Main St | Radiology | Ritvo, Max, 485 Commonwealth Ave Robins, Samuel A, 636 Beacon St | Radiology Roentgenology |
| Kentucky | | Sosman, M C, Peter Bent Brigham Hosp Vance, R G, 264 Beacon St | Roentgenology Roentgenology |
| Ashland Cooper, John Ralph, 1540 Winchester Ave | Roentgenology* | Vogt, E C, 300 Longwood Ave Watts, Henry F, 6 Monadnock St, Dor | Roentgenology Diagnostic roent |
| Lexington Harding, Donnan B, 190 N Upper St | Radiology | Wheatley, Frank E, 520 Beacon St Whelan, Charles, 395 Commonwealth Ave | Roentgenology Radiology |
| Louisville Bell, J C, 332 W Broadway | Radiology | Brockton | |
| Enfield, Charles D, 332 W Broadway | Radiology | Packard, Loring B, 305 Prospect St | Roentgenology |
| Fugate, I T, 332 W Broadway | Radiology | Chelsea | |
| Herrmann, Henry C, 608 S 4th St | Radiology | Hutchinson, R W, U S Naval Hospital | Roentgenology |
| Johnson, S E, 101 W Chestnut St | Roentgenology | Dalton | |
| Keith, D Y, 412 W Chestnut St | Radiology | Sullivan, P J | Roentgenology |
| Keith, J P, 412 W Chestnut St | Radiology | Fall River | |
| Owensboro Gillim, P D, 415 St Ann St | Roentgenology | Lindsey, John H, 151 Rock St | Roentgenology |
| Winchester Browne, I H | Diagnostic roent | Tennis, M N, 538 Prospect St | Radiology |
| Louisiana | | Fitchburg | |
| Alexandria Barker, H O, 327 3d St | Roentgenology | Jennings, Curtis H, 82 Mechanic St | Roentgenology |
| Baton Rouge Williams, Lester J, 221 3d St | Radiology | Haverhill | |
| Houma St Martin, T I | Roentgenology | McFee, William D, 295 Mill St | Roentgenology |
| Mansfield Curtis H P D | Roentgenology | Popoff, Constantine, 26 Summer St | Roentgenology* |
| Monroe Moore, Daniel M, 128 De Siard St | Roentgenology | Sproull, John, 50 Merrimack St | Radiology |
| New Orleans Bowie, E. R, 3503 Prytania St | Radiology | Holyoke | |
| Fortier, L A, 2000 Tulane Ave | Radiology | Harrington, Elmer J, 179 Chestnut St | Roentgenology* |
| Gately T T, 2000 Tulane Ave | Radiology | Lawrence | |
| Granger, Amédée, 921 Canal St | Roentgenology | Burgess, Charles J, 37 Whitman St | Radiology |
| Henderson, W F, 3500 Prytania St | Radiology | Lowell | |
| Menville, L J, 921 Canal St | Radiology | Mehan, Joseph A, 4 Park St | Roentgenology |
| Samuel E. C., 3503 Prytania St | Radiology | Stewart, Ralph C, 226 Central St | Roentgenology |
| Shreveport Barrow, S C, 624 Travis St | Radiology | Malden | |
| Edwards, H G F, 624 Travis St | Roentgenology | Warren, Alva H, 6 Pleasant St | Roentgenology |
| Harwell, W R, 624 Travis St | Radiology | New Bedford | |
| Rutledge, C P, 1030 Highland Ave | Radiology | Bonnar, James M, 90 Hillman St | Roentgenology |
| Thomas, A Jerome, 624 Travis St | Roentgenology | North Adams | |
| Maine | | Bunce, James W, 85 Main St | Roentgenology |
| Auburn Cunningham, C. H, 66 Goff St | Diagnostic roent | Crawford, J W, 191 E. Main St | Radiology |
| Bangor Ames, Forrest B, 489 State St | Roentgenology | Northampton | |
| Hunt Barbara, 224 State St | Radiology | Janes, Benjamin F, 211 Elm St | Roentgenology |
| Portland Cummings, Edson S, 12 Pine St | Diagnostic roent | Somerville | |
| Lamb, Frank W, 131 State St | Diagnostic roent | Blake, Allen H, 81 College Ave, W Som | Roentgenology |
| Thaxter, Langdon T, 2 Arsenal St | Roentgenology | Springfield | |
| Waterville Goodrich, John P, 214 Main St | Diagnostic roent | Davis, Ernest L, 20 Maple St | Roentgenology |
| Maryland | | Horigan, A J, 20 Maple St | Roentgenology |
| Baltimore Ashbury, Howard E, 101 Read St | Roentgenology* | Jackson, Howard L, 146 Chestnut St | Roentgenology |
| Baetjer, Frederick H, 4 E. Madison St | Roentgenology | Powers, Richard T, 25 Maple St | Diagnostic roent |
| Burnam, Curtis F, 1418 Eutaw Pl | Radiology | Van Allen, Harvey W, 19 Maple St | Radiology |
| Evans, John, 101 Read St | Roentgenology | Webster | |
| Feldman, Maurice, 2425 Eutaw Pl | Diagnostic roent | Bragg, Leslie R, 260 Main St | Diagnostic roent |
| Kahn, Max, 904 N Charles St | Roentgenology* | Worcester Cook, Philip H, 27 Elm St | Roentgenology |
| Ostro, Marcus, 1810 Eutaw Pl | Roentgenology | Radium therapy | |
| Pierson, J W, 1107 St Paul St | Roentgenology | Langill, Morton H, 36 Pleasant St | Roentgenology |
| Sax, Benjamin J, 101 Read St | Diagnostic roent | | |
| Michigan | | Adrian | |
| Chase, A W, 130 Toledo St | Diagnostic roent | Ann Arbor Donaldson, Sam W, St Joseph's Mercy Hospital | |
| Hodges, Fred J, University of Michigan | Roentgenology | Battle Creek Peirce, Carleton B, University Hospital | Radiology |
| Gorsline, C S, Old Merchants Tower | Roentgenology | Kolvoord, Theodore, 65 W Michigan St | Roentgenology |
| Upson W O, Leila Y Post Montgomery Hospital | Roentgenology | Upson W O, Leila Y Post Montgomery Hospital | Roentgenology |

| Name and Address | Type of Service | Name and Address | Type of Service | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Americus Pendergrass, R C | Roentgenology | Mattoon Morgan, Charles E, 213 S 17th St. | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Atlanta Clark, James J, 478 Peachtree St N F | Roentgenology | Mount Carmel Elkins, Harold A. | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hall, O D, Georgia Baptist Hospital | Radium therapy | Mount Vernon Smith, Elmer M, 1001½ Broadway | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lake William F, 384 Peachtree St, N F | Roentgenology | Oak Park Rona,ne, Frank J, West Suburban Hospital | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Landham J W, 139 Forrest Ave, N L | Roentgenology | Olney Weber, James A | Diagnostic roent. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Royle, Albert A Steiner Cancer Clinic | Radium therapy | Savannah Holmes L P, 753 Broad St | Radium therapy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stewart, Calvin B Steiner Cancer Clinic | Radium therapy | Ottawa Petit, Roswell T Illinois Valley Hospital | Diag roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Augusta Savannah Cole William A, 20 E Taylor St | Roentgenology | Pearl Goodwin, P B, 530 N Glen Oak Ave | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Corson, Eugene R, 10 W Jones St | Roentgenology | Magee, II B, 408 Main St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drane Robert, Liberty and Drayton Sts | Roentgenology | Quincy Beirne, II P, 648 Hampshire St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| McGee, H II, 14 E Taylor St | Radium therapy | Swanson, Harold, 508 Maine St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Idaho | Roentgenology | Rockford Ackemann, H W, 321 W State St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Boise Genoway, Charles V, 105 N 8th St | Roentgenology | Springfield Obara, I S, 310½ S 5th St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leviston Johnson, Paul W | Roentgenology | Indiana | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Illinois | | Crawfordsville Sigmund, H W, 227 E. Main St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batavia Mstrom, H T | Diagnostic roent Radium therapy | Evanville Cleveland, W R, 22 N W 4th St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Belvidere Algire Alden | Diagnostic roent | Meyer, Keith T, Protestant Deaconess Hosp | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bloomington Cantrell Thomas, 310 E Jefferson St | Radiology | Smith, William L, 412 S E 4th St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grote, Henry W, 219 N Main St | Radiology | Fort Wayne Rodriguez, Juan, 2902 Fairfield Ave | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chicago Arens, Robert A, 2839 Ellis Ave | Radiology | Steele, M F, 116 E Berry St | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beilin, David S, 411 Garfield Ave | Radiology | Truelove, G O, 347 W Berry St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blackmarr, Frank H, 25 E Wash St | Roentgen therapy | Van Buskirk, E M, 347 W Berry St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Brams, Julius, 180 N Michigan Ave | Radium therapy | Gary Dietrich, Paul H, St Mary's Mercy Hosp | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Brown, William L, 55 E Wash St | Roentgenology | Indianapolis Beeler, R C, 23 E. Ohio St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Casellas, P R, 1525 E. 53d St | Radium therapy | Collins, J N, 23 E. Ohio St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Challenger, C J, 3117 Logan Blvd | Roentgenology | Lochry, R L, St Vincent's Hospital | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cook, Carroll E, 30 N Michigan Ave | Radiology | Smith, L A, 23 E. Ohio St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Culpepper, William L, 1305 E 63d St | Roentgenology | Stayton, Chester A, 23 E. Ohio St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cushway, B C, 7752 S Halsted St | Radiology | Kokomo Ferry, Paul W, 224 N Main St | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cutrer, Peter, 501 S Halsted St | Diagnostic roent | LaFayette McClelland, D C, 308 N 8th St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Damiani, Joseph, 767 Milwaukee Ave | Roentgenology | Michigan City Martin, F V, 501 Pine St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Davis, H E, 2548 Lake View Ave | Diagnostic roent | Muncie Moore, P D, Jackson and High Sts | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dick, Paul G, 55 E Washington St | Roentgenology | New Castle Herman, George E, 1319 Church St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ford, Charles, 8017 Luella Ave | Roentgenology | Plymouth Knott, Harry | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gilmore, Wilbur H, 185 N Wabash Ave | Roentgenology | Shelbyville Inlow, Herbert H, 2 W Washington St | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grubbe, Emil H, 6 N Michigan Ave | Roentgen therapy | Terre Haute Pierce, H J, 627 Cherry St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hartung, Adolph, 25 E Washington St | Radiology | Union City Reid, Robert W | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hodges, Paul C, 928 E 59th St | Radiology | Valparaiso DeWitt, C H | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hubeny, M J, 25 E Washington St | Roentgenology | Vincennes Moore, Robert G, 21 N 3d St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jenkinson, David L, 1931 Wilson Ave | Roentgenology | Iowa | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jenkinson, E L, 1439 S Michigan Ave | Radiology | Anamosa Rawson, E G | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kraft, Ernest, 950 E 59th St | Roentgenology | Atlantic Greenleaf, W S | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Landau, George M, 660 Grosland Park | Roentgenology | Belle Plaine Newland, Don H | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Larkin, A. James, 25 E Washington St | Radium therapy | Cedar Rapids Erakine, Arthur W, 120 3d Ave SE | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Litschi, Joseph J, 551 Grant Pl | Roentgenology | Des Moines Burcham, Thomas A, 410 6th Ave | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maier, Roy J, 7752 S Halsted St | Radiology | Dubuque Johnston, Wayne A, 1200 Main St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| McClure, C F, 25 E Washington St | Roentgenology | Eagle Grove Christensen, John R | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Olin, Harry, 6058 Drexel Blvd | Roentgenology | Independence Sheehan, J C | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Orndoff, B H, 2551 N Clark St | Roentgenology | Iowa City Gibson, W H, University Hospitals | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Potter, Hollis E, 122 S Michigan Ave | Roentgenology | Kerr, H Dabney, University Hospitals | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rose, Cassie Belle, 1753 W Congress St | Radiology | Le Mars Larsen, W W | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Royer, Don J, 841 E 63d St | Roentgenology | Marshalltown Talley, Louis F, Evangelical Deaconess Home and | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tichy, L S, 3200 W 22d St | Roentgenology | Hospital | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Trostler, I S, 25 E Washington St | Radiology | Wanninger, W J, 9116 Exchange Ave | Roentgenology | New Hampton Chandler, Orville B | Diagnostic roent | Warden, R H, 1044 N Francisco Ave | Radiology | | | Warfield, C H, Cook County Hospital | Roentgenology | | | Willy, R G, 2749 W Foster Ave | Roentgenology | | | Danville Allison, Otis W, 9 W Main St | Radium therapy | | | Archibald, James S, 602 Green St | Roentgenology | | | Dunham, L H, 139 N Vermilion St | Radiology | | | Deerfield Davis, Charles J | Roentgenology | | | East St Louis Echternacht, A C, 129 N 8th St | Radiology | | | Evanson Alexander, William G, 636 Church St | Radiology | | | Conley, Bernard M, St Francis Hospital | Roentgenology | | | Perry, Gentz, 636 Church St | Radiology | | | Galesburg Gunning, R E Lee, 64 S Prairie St | Radiology | | | Highland Park Jacks, R R, 16 N Sheridan Rd | Diagnostic roent | | | Joliet Houston, Alfred N, 201 N Chicago St | Roentgenology | | |
| Wanninger, W J, 9116 Exchange Ave | Roentgenology | New Hampton Chandler, Orville B | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Warden, R H, 1044 N Francisco Ave | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Warfield, C H, Cook County Hospital | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Willy, R G, 2749 W Foster Ave | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Danville Allison, Otis W, 9 W Main St | Radium therapy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Archibald, James S, 602 Green St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dunham, L H, 139 N Vermilion St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deerfield Davis, Charles J | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| East St Louis Echternacht, A C, 129 N 8th St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Evanson Alexander, William G, 636 Church St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conley, Bernard M, St Francis Hospital | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Perry, Gentz, 636 Church St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Galesburg Gunning, R E Lee, 64 S Prairie St | Radiology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Highland Park Jacks, R R, 16 N Sheridan Rd | Diagnostic roent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Joliet Houston, Alfred N, 201 N Chicago St | Roentgenology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Name and Address | Type of Service | Name and Address | Type of Service |
|---|-------------------|--|-------------------|
| Flemington | | Glens Falls | |
| Tompkins, G B | Diagnostic roent | Birdsall, Edgar, 140 Glen St | Roentgenology |
| Hoboken | | Gloversville | |
| Broeser, Henry V, 105 Newark St | Roentgenology | Denham, H C, 12 Prospect Ave | Roentgenology |
| Jersey City | | Hempstead | |
| Mayer, William W, 532 Bergen Ave | Roentgenology | Robin, Nathaniel H, 131 Fulton Ave | Roentgenology |
| Perlberg, Harry J, 921 Bergen Ave | Roentgenology | Williams, P A, 131 Fulton Ave | Roentgenology* |
| Montclair | | Hornell | |
| Schimmelpfennig, R D, 65 N Fullerton Ave | Roentgenology | Mitchell, George W, 208 Main St | Roentgenology |
| Stevens J Thompson, 55 Park St | Radiology | Hudson | |
| Newark | | Harris, Rosslyn P, 427 Warren St | Diagnostic roent |
| Baker, Charles F, 198 Clinton Ave | Roentgenology* | Lackawanna | |
| Celber Louis J, 41 Lincoln Ave | Roentgenology | Cotter, Stephen V, 1457 Abbott Rd | Roentgenology |
| Hood, Philip G, 19 Lincoln Park | Diagnostic roent | Mechanicsville | |
| May, Ernst A, 965 Broad St | Radiology | Green, George A | Diagnostic roent |
| Reissman, Erwin, 31 Lincoln Park | Diagnostic roent | Mount Kisco | |
| Passaic | | Vaughan, F E | Diagnostic roent |
| Terhune, Percy H, 171 Paulison Ave | Roentgenology | Newburgh | |
| Peterson | | Miller, Raymond A, 212 Grand St | Diagnostic roent |
| Golding, Harry N, 180 Carroll St | Roentgenology | Reed Charles B, 205 Liberty St | Roentgenology |
| Roemer Jacob, 213 Broadway | Radiology | New Rochelle | |
| Rochelle Park | | Duckworth, Willard D, 421 Huguenot St | Roentgenology |
| Pallen, C de S | Radium therapy | New York City | |
| Succasunna | | Arons, Isidore, 30 E 49th St | Roentgen therapy |
| Plume, C A | Diagnostic roent | Radium therapy | |
| Summit | | Bendick, Arthur J, 100 E 94th St | Radiology |
| Tidaback, John D, 382 Springfield Ave | Roentgenology | Besser, Herman, 66 E 56th St | Roentgenology |
| Trenton | | Carty, John R, 27th St and 1st Ave | Roentgenology |
| Davison, R Winthrop 200 E State St | Radiology | Cole, Lewis Gregory, 36 E 61st St | Roentgenology* |
| New Mexico | | Dieffenbach, W H, 50 Central Park West | Radiology |
| Albuquerque | | Dixon, George S, 218 2d Ave | Diagnostic roent |
| Warden, M R, St Joseph's Hospital | Diagnostic roent | Ferguson, A D, 420 E 59th St | Roentgenology |
| New York | | Fineman, S, 40 E 49th St | Diagnostic roent. |
| Albany | | Freidick, Jacob R, 1049 Park Ave | Radiology |
| Howard, W P, 46 Willett St | Roentgenology | Friedman, Lewis J, 315 E 18th St | Roentgenology |
| Prentice, D D, 59 Clinton Ave | Radiology | Glassman, I, 138 E 36th St | Diagnostic roent. |
| Amsterdam | | Golden, Rose, 622 W 168th St | Roentgenology |
| Wilson, David, 156 Guy Park Ave | Roentgenology | Gottlieb, Charles, 210 W 79th St | Roentgenology |
| Auburn | | Groeschel, L B, 40 W 72d St | Radiology |
| Austin Sedgwick E, 54 E Genesee St | Diagnostic roent. | Hirsch, Henry, 2075 Grand Concourse | Radiology |
| Bull, Harry S, 10 South St | Roentgenology | Hirsch, I Seth, 136 E 64th St | Radiology* |
| Binghamton | | Howard, J Campbell, 40 E 61st St | Roentgenology |
| Kann, Ulysses S, 69 Walnut St | Radiology | Imboden, Harry M, 30 W 59th St | Radiology |
| Brooklyn | | Jaches, Leopold, 100 E 94th St | Radiology |
| Bayles, William H, 1901 Bedford Ave | Diagnostic roent | Kaplan, Ira I, 55 E 86th St | Roentgen therapy |
| Bell, A L Loomis, 340 Henry St | Radiology | Radium therapy | |
| Cramp, George W, Methodist Episcopal Hosp | Diagnostic roent | Kaplan, Morris, 130 Henry St | Diagnostic roent |
| Currin, Francis W, 1136 Dean St | Radiology | Katz, Harry, 141 Broome St | Diagnostic roent |
| Dannenberg Max, 1464 Eastern Parkway | Roentgenology | Kurz, Bernard, 1235 Grand Concourse | Diagnostic roent |
| Eastmond, Charles, 483 Washington Ave | Roentgenology* | Landsman, I J, 391 E 149th St | Diagnostic roent |
| Ehrenpreis, B, 576 Eastern Parkway | Roentgenology | Lapman, Charles 2754 Grand Concourse | Diagnostic roent. |
| Elliott, F E, 122 76th St | Diagnostic roent | Law, Frederick M, 140 E 54th St | Diagnostic roent. |
| Friedmann Asa B, 41 Eastern Parkway | Radiology | Lefrak, Louis, 251 E Broadway | Diagnostic roent. |
| Gold, Louis, 835 Willoughby Ave | Diagnostic roent | Lenz, Maurice, 1049 Park Ave | Roentgen therapy |
| Goldfarb, L, 608 Ocean Ave | Diagnostic roent. | Radium therapy | |
| Howes William E, 152 Clinton St | Roentgenology | LeWald, L T, 140 E 54th St | Roentgenology |
| Ingraham, Ruth, 121 DeKalb Ave | Diagnostic roent | Lewis, Raymond W, 30 E 40th St | Diagnostic roent. |
| Kaufman Julius, 201 Eastern Parkway | Roentgenology | Meyer, William Henry, 1 University Place | Roentgenology* |
| Levine, Isaac, 1219 49th St | Diagnostic roent | Philips Herman B, 9 W 68th St | Radiology |
| Liberson, F, 612 Eastern Parkway | Diagnostic roent | Pomeranz, M M, 911 Park Ave | Radiology |
| Masterson John J, 401 76th St | Roentgenology | Powell, C B, 2368 7th Ave | Diagnostic roent |
| Rendich, Richard A, 116 Remsen St | Roentgenology | Quimby, Adoniram J, 5 E 57th St | Roentgenology |
| Schenck, Samuel G, 1538 President St | Diagnostic roent | Remer, John, 200 W 59th St | Radiogen therapy |
| Schiff, Charles H, 1000 Park Pl | Diagnostic roent | Robinson, G Allen 2 E 77th St | Radium therapy |
| Strahl, Milton I, 255 New York Ave | Diagnostic roent | Robinson, William T, 322 W 72d St | Roentgenology |
| Taormina, Louis J, 1093 Gates Ave | Roentgenology | Ryan, E J, St Luke's Hospital | Roentgenology |
| Tepperow, H I, 1488 Eastern Parkway | Radiology | Scholz, Thomas, 38 E 85th St | Diagnostic roent |
| Wasch, Milton G, 871 Park Pl | Radiology | Schwartz, C W, 33 E 68th St | Roentgenology |
| Buffalo | | Schwartz, Irving 1150 5th Ave | Diagnostic roent |
| Barnes, John M, Millard Fillmore Hosp | Roentgenology | Spillman, Ramsay, 115 E 61st St | Diagnostic roent |
| Bayless, J W, 472 Delaware Ave | Diagnostic roent | Steiner, Joseph M, 170 East End Ave | Roentgenology* |
| DeGraft, Ralph M, 131 Linwood Ave | Diagnostic roent | Stewart, William H, 222 W 79th St | Roentgenology |
| Gian Franceschi, J S, 610 Niagara St | Diagnostic roent | Taylor, Henry K, 333 West End Ave | Diagnostic roent |
| Helminski, M J, 929 Fillmore Ave | Diagnostic roent | Unger, Arthur S, 135 E 74th St | Roentgenology |
| Koenig, Edward C, 100 High St | Diagnostic roent | Valenti Mestre, A F, 129 Broad St | Roentgenology |
| Lape C Pearley, 183 Oxford Ave | Diagnostic roent | Weinberg, Tobias B, 310 E 15th St | Roentgenology |
| Levy, Sidney H, 33 Allen St | Diagnostic roent | Weitzner, Samuel F, 1018 E 163d St | Roentgenology |
| Levyn, Lester, 40 North St | Roentgenology | Niagara Falls | |
| Orr, Clifford R, 1093 Ellicott St | Diagnostic roent | Scott, Walter Roger, 598 Pine Ave | Radiology |
| Schreiber, B F, 113 High St | Radiology | Ossining | |
| Smith, B B, 333 Linwood Ave | Diagnostic roent | Wyser, Dorean D, Ossining Hospital | Roentgenology |
| Thompson, A W, 135 Linwood Ave | Diagnostic roent | Oswego | |
| Cooperstown | | Lavine, Reuben, 25 W Oneida St | Diagnostic roent |
| Cruttenden, Harry L | | Wallace, H M, 140 W 5th St | Roentgenology |
| Corlton | | Peekskill | |
| Sornberger, Frank F, 16 Church St | Roentgenology | Snowden, Fred A, 108 Depew St | Roentgenology |
| Elmira | | Port Chester | |
| Bennett, John A, 222 W Church St | Roentgenology | West, Theodore S, 324 Westchester Ave | Radiology |
| Far Rockaway | | Davison, Chester O, Vassar Brothers Hospital | Radiology |
| Rivkin, Hyman, 918 Cornaga Ave | Diagnostic roent | Richmond Hill | |
| | | Voltz, Albert L, 11520 Myrtle Ave | Radiology |
| | | Rochester | |
| | | Almy, Max A, 16 N Goodman St | Roentgenology |
| | | Davidson, Sol C, 277 Alexander St | Radiology |
| | | Flynn, James M, 277 Alexander St | Radiology |
| | | Green, Joseph H, 277 Alexander St | Roentgenology |

| Name and Address | Type of Service | Name and Address | Type of Service |
|--|------------------|--|------------------|
| Bay City | | Joplin | |
| Moffatt, Francis J., Mercy Hospital | Roentgenology | McCaughay, H. D., 607 Main St. | Radiology |
| Detroit | | Kansas City | |
| Berry, J. M., 10 Peterboro St. | Diagnostic roent | Dann, David S., 304 E. 12th St. | Roentgenology |
| Birkelo, Carl C., 28 W Adams Ave. | Roentgenology | DeWeese, L. R., 904 Grand Ave. | Roentgenology |
| Bloom, Arthur R., 5057 Woodward Ave. | Roentgenology | Donaldson, C. O., 1103 Grand Ave. | Radiology |
| Chene, George C., 1551 Woodward Ave. | Roentgenology | Lockwood, Ira H., 304 E. 12th St. | Radiology |
| Dempster, James H., 1551 Woodward Ave. | Roentgenology | McCandless, O. H., 308 E. 12th St. | Roentgenology |
| Doub, Howard P., Henry Ford Hospital | Diagnostic roent | McDermott, J. L., 1103 Grand Ave. | Radiology |
| Evans, William A., 10 Peterboro St. | Radiology | Skinner, Edward H., 1103 Grand Ave. | Radiology |
| Hasley, Clyde K., 1551 Woodward Ave. | Radiology | Virden, C. E., 1103 Grand Ave. | Radiology |
| Jarr, Hans A., 1551 Woodward Ave. | Radiology | St. Joseph | |
| Kenning, J. C., 28 W Adams Ave. | Roentgenology | McGlothlan, A. B., 824 Edmond St. | Roentgenology* |
| Lim, W. K., 2201 E. Jefferson Ave. | Radiology | Ravold, Henry J., 401 N. 6th St. | Roentgenology |
| Loucks, R. E., 337 W Grand Blvd. | Radiology | St. Louis | |
| Minor, Edward G., 3001 W Grand Blvd. | Roentgenology | Finst, Edwin C., 3720 Washington Ave. | Radiology |
| Reynolds, Lawrence, 10 Peterboro St. | Radiology | McCutchon, L. G., 508 N Grand Blvd. | Roentgenology* |
| Sanderson, S. E., 5057 Woodward Ave. | Radiology | Moore, Sherwood Barnes Hospital | Radiology |
| Shore, O. J., 3001 W Grand Blvd. | Roentgenology | Muller, Wilbur K., 607 N Grand Blvd. | Roentgenology |
| Stevens, Rollin H., 1551 Woodward Ave. | Radiology | Peden, Joseph C., 634 N Grand Blvd. | Roentgenology |
| Ulrich, Henry L., 1122 E. Grand Blvd. | Roentgenology | Sante, L. R., 634 N Grand Blvd. | Radiology |
| Weaver, Clarence F., 113 Martin Pl. | Roentgenology | Spinney, Edgar W., 508 N Grand Blvd. | Roentgenology |
| Flint | | Titterington, P. F., 508 N Grand Blvd. | Roentgenology |
| MacDuff, Robert B., Hurley Hospital | Roentgenology | Zink, Oscar C., St. Luke's Hospital | Roentgenology |
| Grand Rapids | | Springfield | |
| Menees, Thomas O., Blodgett Memorial Hosp. | Radiology | Cole, Paul F., 200 Pershing Ave. | Radiology |
| Moore, Vernon V., 110 E. Fulton St. | Radiology | Webster Groves | |
| Muller, John H., 26 Sheldon Ave. | Radiology | Herrigan, Joseph A., 421 S. Elm St. | Diagnostic roent |
| Williams, Alden H., 26 Sheldon Ave. | Radiology | | Montana |
| Jackson | | Billings | |
| Cooley, R. M., Mercy Hospital | Roentgenology | Brudenbaugh, J. H., 208 N. Broadway. | Radiology |
| Kugler, J. C., 1905 Grovedale Ave. | Roentgenology | Witkin, C. F., 115 N. 28th St. | Radiology |
| Porter, H. W., 1020 E. Michigan Ave. | Radiology | Great Falls | |
| Kalamazoo | | Walker, Dora, 503 1st Ave. N. | Roentgenology |
| Crane, A. W., 420 S. Rose St. | Roentgenology* | | Nebraska |
| Jackson, John B., 420 S. Rose St. | Roentgenology* | Beatrice | |
| Lansing | | Penner, H. G., 113 S. 5th St. | Roentgenology* |
| Davenport, Carroll S., St. Lawrence Hosp. | Roentgenology* | Rush, Weaver A., 112½ S. 6th St. | Radiology |
| Monroe | | Grand Island | |
| Moll, T. M., 120 Maple Blvd. | Diagnostic roent | Woodruff, R. C., 306½ N. Locust St. | Roentgenology |
| Pontiac | | Hastings | |
| Church, J. E., 35 W. Huron St. | Roentgenology | Rork, Lee W., 119 N. Hastings Ave. | Roentgenology* |
| Pool, H. H., 35 W. Huron St. | Roentgenology | Lincoln | |
| Saginaw | | Kail, Carl, 1307 N. St. | Roentgenology* |
| Anderson, William K., 316 S. Porter St. | Diagnostic roent | Rowe, Edward W., 128 N. 13th St. | Radiology |
| St. John | | Smith, Rosece L., 1307 N. St. | Radiology |
| Ho, T. Y. | Diagnostic roent | Omaha | |
| Traverse City | | Fouts, Roy W., 107 S. 17th St. | Radiology |
| Minor, E. B., 208½ E. Front St. | Diagnostic roent | Hardy, Clyde C., 101 S. 17th St. | Roentgenology |
| Ypsilanti | | Hunt, Howard B., Nebraska Methodist Episcopal Hospital | Roentgenology |
| Pillsbury, Charles B., 23B N. Wish St. | Diagnostic roent | Kelly, J. F., 107 S. 17th St. | Radiology |
| Duluth | | Overgaard, A. P., 107 S. 17th St. | Roentgenology |
| Clement, Gage, 901 E. 1st St. | Radiology | Ross, W. L., 407 S. 16th St. | Roentgenology |
| Mankato | | Tyler, Albert F., 103 S. 17th St. | Radiology |
| Wentworth, A. J., Mankato Clinic | Radiology | Scottsbluff | |
| Minneapolis | | Plehn, Frank W. | Roentgenology |
| Allison, R. G., 74 S. 9th St. | Roentgenology* | | Nevada |
| Fleming, A. S., 900 Nicollet Ave. | Radium therapy | Reno | |
| Harrington, Charles D., 78 S. 9th St. | Radiology | Piersall, C. E., 120 N. Virginia St. | Radiology |
| Nordin, G. T., 74 S. 9th St. | Roentgenology | | New Hampshire |
| Rigler, Leo G., University Hospital | Diagnostic roent | Concord | |
| Sundt, Mathias, 2323 6th St. S. | Roentgenology | Evelich, Fred S., 12 Court St. | Roentgenology |
| Ude, Walter H., 74 S. 9th St. | Roentgenology* | Dover | |
| Rochester | | Chesley, Harry O., 507 Central Ave. | Roentgenology |
| Bowing, Harry H., 102 2d Ave. | Roentgenology | Hanover | |
| Camp, John D., Mayo Clinic | Radium therapy | Sycamore, Leslie K., Mary Hitchcock Memorial Hospital | Radiology |
| Desjardins, A. U., Mayo Clinic | Diagnostic roent | Manchester | |
| Ford, Frances A., Mayo Clinic | Radium therapy | Merrill, A. S., 944 Elm St. | Roentgenology |
| Fricke, Robert E., Mayo Clinic | Radium therapy | Nashua | |
| Kirklin, B. R., Mayo Clinic | Diagnostic roent | Davis, S. G., 168 Main St. | Roentgenology |
| Leddy, Eugene T., Mayo Clinic | Radium therapy | Rock, T. F., 77 Main St. | Diagnostic roent |
| Sutherland, Charles G., Mayo Clinic | Diagnostic roent | | New Jersey |
| Weber, Harry M., Mayo Clinic | Diagnostic roent | Asbury Park | |
| St. Cloud | | Herriman, William G., 501 Grand Ave. | Radiology |
| Kern, M. J., St. Mary's Bldg. | Roentgenology* | Atlantic City | |
| St. Paul | | Bradley, Robert A., 1616 Pacific Ave. | Radiology |
| Aurelius, J. R., 350 St. Peter St. | Roentgenology* | Kaighn, Charles B., 905 Pacific Ave. | Roentgenology |
| Schons, Edward, 350 St. Peter St. | Radiology | Camden | |
| Gulfport | | Roberts, Joseph E., 403 Cooper St. | Roentgenology |
| Sims, George P., 1005 32d Ave. | Diagnostic roent | East Orange | |
| Laurel | | Marquis, W. James Homeopathic Hospital of Essex County | Roentgenology |
| McCormick, H. G., 531 7th St. | Roentgenology | Reitter, George S., 144 Harrison St. | Diagnostic roent |
| McComb | | Elizabeth | |
| Ratcliff, M. D., Maryland and 4th Sts. | Diagnostic roent | Vogel, Herbert A., 1060 E. Jersey St. | Diagnostic roent |
| Natchez | | Ward, Leo J., 137 W. Jersey St. | Radiology |
| Beekman, Marcus, 307 Franklin St. | Diagnostic roent | Englewood | |
| Holden | | Edwards, James B., Englewood Hospital. | Roentgenology |
| Thompson, William G. | Radiology | | |
| Mississippi | | | |
| Missouri | | | |

| Name and Address | Type of Service | Name and Address | Type of Service |
|--|---------------------------------|--|-------------------|
| Erie Putts, B Swayne, 117 W 8th St | Roentgenology | Rochester McCaskey, F H | Roentgenology |
| Greensburg McMurray, H A, 107 S Main St | Roentgenology | Scranton Jackson, B H, 327 N Washington Ave | Radiology |
| Hanover Bortner, C E, 123 York St | Diagnostic roent. | Milkman, Louis A, 327 N Washington Ave | Roentgenology |
| Harrisburg Ritzman, A Z, 234 State St | Roentgenology | von Posvirk, Gisela, 217 Jefferson Ave | Roentgenology |
| Hatboro Shoemaker, Robert, III | Roentgenology | Shippenburg Stewart, Alexander | Roentgenology |
| Hazleton Dessen, Louis A, 4 W Broad St | Roentgenology | Tamaqua Hinkel, William H, 243 E. Broad St | Roentgenology |
| Huntingdon Keichline, John M | Radiology | Uniontown Hess, George H, 104 Morgantown St | Roentgenology |
| Johnstown Stewart, H M, 406 Main St | Radiology | West Chester Pennell, Howard Y, Chester County Hosp | Roentgenology |
| Kingston Howell G L, Kingston Corners Bldg | Roentgenology | Wilkes-Barre DesJardins, A, Wilkes Barre Gen Hosp | Roentgenology* |
| Lancaster Davis, Henry B, 530 N Lime St | Roentgenology Radium therapy | Rogers, Lewis L, 38 N Franklin St | Roentgenology |
| Snock, Paul O, 530 N Lime St | Roentgenology | Wilkinsburg McGregor, William J, 901 Wood St | Roentgenology |
| Swab, Robert D, 23 E Walnut St | Roentgenology | Williamsport Schneider, George L, 212 Pine St | Roentgenology |
| Lebanon Boger, John D, 341 Cumberland St | Diagnostic roent. | Wursted, L E, 416 Pine St | Roentgenology |
| Lewistown Weaver, O M, 12 S Main St | Roentgenology | York Bennett, J H, 1253 W Market St | Radiology |
| Lock Haven Green, George D | Roentgenology | Landes, L S, 454 W Market St | Diagnostic roent. |
| McKeesport Snedden, A R, 522 Walnut St | Roentgenology | Lutz, J Fletcher, 141 E Market St | Roentgenology |
| Meadville Gingold, Joseph R, Spencer Hospital | Roentgenology | | |
| New Castle Cooper, J R, 111 E. North St | Radiology | | |
| Norristown Campbell, Raymond F, 514 Swede St | Diagnostic roent. | | |
| Perkasie Strouse, O H | Roentgenology | | |
| Philadelphia Barker, Walter C, Chestnut and 20th Sts | Radiology | | |
| Bird, G C, 1415 W Erie St | Roentgenology | | |
| Borzell, Francis F, 4940 Penn St | Roentgenology | | |
| Bowen, David R, Pennsylvania Hospital | Radiology | | |
| Bromer, Ralph S, Hospital of the Protestant Episcopal Church | Roentgenology | | |
| Bruck, Samuel, 2104 Pine St | Roentgenology | | |
| Carpenter, Samuel A, 2265 N 16th St | Roentgenology | | |
| Chamberlain, W E, Temple Univ Hosp | Radiology | | |
| Clagett, A H, 1737 Chestnut St | Roentgenology | | |
| Cohen, Leon Solis, 1923 Spruce St | Roentgenology | | |
| Downs, E E, Jeannies Hospital | Radiology | | |
| Edeiken, Louis, 1923 Spruce St | Radiology | | |
| Farnell, John T Jr, 235 S 15th St | Roentgenology* | | |
| Gershon Cohen, J, 1832 Spruce St | Roentgenology | | |
| Henry, Robert W, 768 S 15th St | Roentgenology | | |
| Koenig, Carl F, 1734 Harrison St | Roentgenology | | |
| Manges, Willis F, 235 S 15th St | Roentgenology* | | |
| Morgan, J D, 2226 Delancey St | Radiology | | |
| Newcomer, W S, 3501 Baring St | Radiology | | |
| Pancoast, Henry K, 3400 Spruce St | Radiology | | |
| Pendergrass, Eugene P, 3400 Spruce St | Radiology | | |
| Percival, M F, Methodist Episcopal Hosp | Radiology | | |
| Pfahler, George E, 1321 Spruce St | Radiology | | |
| Post, Joseph W, 1930 Chestnut St | Roentgenology | | |
| Rieger, Charles L W, Habermann Medical College Hospital | Roentgenology* | | |
| Rosenbaum, George, 1521 Spruce St | Radiology | | |
| Schmidt, William Henry, 1601 Walnut St | Radiology | | |
| Sender, Arthur C, 1311 W Allegheny Ave | Roentgenology | | |
| Spackman, E W, 1824 Chestnut St | Roentgenology | | |
| Still, H Tuttle, 3300 N Broad St | Roentgenology | | |
| Vastine, Jacob H, 1321 Spruce St | Radiology | | |
| Widmann, B P, 250 S 18th St | Radiology | | |
| Wiley, Louis R, 1512 N 15th St | Roentgenology | | |
| Zulick, J Donald, 2008 Walnut St | Roentgenology | | |
| Philipsburg Benson, Andrew L | Roentgenology | | |
| Pittsburgh Alley, Reuben G, Western Pennsylvania Hospital | | | |
| Caldwell, C S, 520 S Aiken Ave | Diagnostic roent. | | |
| Fisher, J W, 500 Penn Ave | Diagnostic roent. | | |
| Gorfinkell, Julius, 3401 5th Ave | Roentgenology | | |
| Grier, G W, 500 Penn Ave | Radiology | | |
| Grimm, Homer W, 500 Penn Ave | Radiology | | |
| Johnston, Z A, 500 Penn Ave | Radiology | | |
| McAdams, Edward C, 119 S Highland Ave | Roentgenology | | |
| McCullough, John F, 500 Penn Ave | Radiology | | |
| Ray, William B, 110 E Stockton Ave | Roentgenology* | | |
| Robinson, Ralph V, 500 Penn Ave | Radiology | | |
| Schaefer, C N, 500 Penn Ave | Radiology | | |
| Schumacher, F L, 500 Penn Ave | Roentgenology | | |
| Reading Metter, Edward G, 230 N 5th St | Roentgenology* | | |
| Travis, Richard C, 249 N 5th St | Radiology | | |
| Amarillo Van Sweringen, Walter, 301 Polk St | Roentgenology | | |
| Vaughan, John H, 724 Polk St | Radiology | | |

RADIOLOGY

| Name and Address | Type of Service | Name and Address | Type of Service |
|---------------------------------------|-------------------|--------------------------------------|-------------------|
| Palmer, Myron B 277 Alexander St | Radiology | Riebel Frank A, 15 W Goodale St | Roentgenology |
| Sinders, L J 213 Alexander St | Roentgenology | Weirauck, H V, 9 Buttles Ave | Roentgenology |
| Thomas Camp C, 476 Lake Ave | Roentgenology | Burnett Harry W, 201 S Main St | Radiology |
| Saratoga Springs | | Delscamp, W H, 201 S Main St | Roentgenology |
| King Earl II, 75 Caroline St | Roentgenology | Jones, Lynn M, 117 S Main St | Roentgenology* |
| Syracuse | | Fremont | |
| Calia, Salvatore, 510 Prospect Ave | Diagnostic roent. | Philo D W, 209 W State St | Roentgenology |
| Childs Donald S, 713 E Genesee St | Roentgenology | Gillipolis | |
| Henry Lucas S, 116 E Castle St | Roentgenology | Wilson, Milo | |
| Potter Carlton T, 920 S Crouse Ave | Roentgenology | Hamilton | Radiology |
| Rulison, Foster C, 713 E Genesee St | Roentgenology | Benzing George, R.D. 3 | Radiology |
| Troy | | Lakewood | |
| Hull Thurman A 505 Broadway | Diagnostic roent. | McDowell John R, 15701 Detroit Ave | Roentgenology |
| Utica | | Shetter North W, 14600 Detroit Ave | Roentgenology |
| Powers M T, 250 Genesee St | Roentgenology | Lima | |
| Watertown | | Thomas Herbert A, 131 N Elizabeth St | Radiology |
| Pawling, Jesse R 100 Stone St | Roentgenology | Massillon | |
| White Plains | Radium therapy | Holston J D, Massillon City Hospital | Diagnostic roent. |
| Duckworth R D, 57 Maple Ave | Roentgenology | Piqua | |
| Sherman Herbert 99 Church St | Roentgenology | Spencer Robert D 400 N Main St | Roentgenology |
| North Carolina | | Salem | |
| Asheville | | Heck Stanton 1160 E. State St | Roentgenology |
| Murphy G W, Flat Iron Bldg | Roentgenology* | Springfield | |
| Charlotte | | Bruhlker E. R., 8 W Main St | Radiology |
| Lafferty Robert H 127 W 7th St | Radiology | Steubenville | |
| Phillips Clyde C, 19 W 7th St | Radiology | Miller, J E, 401 Market St | Radiology |
| Durham | | Toledo | |
| Reeves R J Duke Hospital | Radiology | Kahn Dalton 237 Michigan St | Roentgenology |
| Greensboro | | Murphy John T, 421 Michigan St | Radiology |
| Rhudy Booker E, 101 N Elm St | Roentgenology | Warren | |
| Raleigh | | Gauchat, Paul C 197 W Market St | Roentgenology |
| Noble Robert P 131 W Hargett St | Roentgenology* | Simpson D G, 1 Main St | Roentgenology |
| Statesville | | Youngstown | |
| McElwee R S Stearns Bldg | Roentgenology | Bachman V H, 314 N Phelps St | Roentgenology* |
| Winston-Salem | | Heherding, John 151 W Rayen Ave | Roentgenology |
| Rousseau J P, 310 W 4th St | Radiology | Heeley J A Youngstown Clinic | Roentgenology |
| North Dakota | | Meyer A N, 23 Central Square | Diagnostic roent. |
| Bismarck | | Zanesville | |
| Berg, Henning Milton 221 5th St | Roentgenology* | Holston J G F, 620 South St | Roentgenology |
| Fargo | | Oklahoma | |
| Rothuem Thomas Peter, 804 Broadway | Roentgenology | Enid | |
| Grand Forks | | Newell W B, 502 N Independence St | Roentgenology |
| Woutat H G, 318 DeMers Ave | Roentgenology | Midway | |
| Minot | | Talley, C N | Diagnostic roent. |
| Gates Russell 20 4th Ave SW | Roentgenology* | McAlester | |
| Ohio | | Johnston James C, 216½ E Choctaw Ave | Roentgenology |
| Akron | | Oklahoma City | |
| Beals John A St Thomas Hospital | Diagnostic roent. | Heatley John E, 119 N Broadway | Diagnostic roent. |
| Selby, John H 159 S Main St | Roentgenology | Myers Ralph Emerson 1200 N Walker St | Radiology |
| Stall A H City Hospital | Radiology | Roland Marion M 119 N Broadway | Radiology |
| Stewart J E, 159 S Main St | Roentgenology | Shawnee | |
| Ashtabula | | Hughes, J E, 14 E. 9th St | Diagnostic roent. |
| Collinder P J, 217 Park Pl | Roentgenology | Radium therapy | |
| Canton | | South Sulphur | |
| Peters Chester M 709 Cleveland Ave NW | Radiology | Annadown, P V | Diagnostic roent. |
| Peterson E O, 120 Tuscarawas St W | Roentgenology* | Larrabee W S 108 W 6th St | Roentgenology |
| Short John E, 427 Market Ave S | Roentgenology* | Ihevine Morris B 108 W 6th St | Diagnostic roent. |
| Chillicothe | | Stuart, Leon H 7 W 6th St | Roentgenology |
| Holmes Ralph W 57 W Main St | Roentgenology | Oregon | |
| Cincinnati | | Portland | |
| Bader E R 628 Elm St | Radiology | Dixon William 193 11th St | Diagnostic roent. |
| Brodberger William L, 25½ Eastern Ave | Roentgenology | Haworth Wallace 193 11th St | Roentgenology |
| Brown, Samuel 707 Race St | Roentgenology* | Palmer Dorwin L, 430 Morrison St | Radiology |
| Doughty William M 628 Elm St | Radiology | Walker Ralph C, 364 Washington St | Radiology |
| Goosmann Charles 22 W 7th St | Radiology | Wight Otto B 193 11th St | Radium therapy |
| Lange Sidney 19 Garfield Place | Radiology | Pennsylvania | |
| Reincke Harold G Cincinnati Gen Hosp | Roentgenology* | Allentown | |
| Warne B M, 19 Garfield Place | Roentgenology | Smyth Thomas L, 111 N 8th St | Radiology |
| Cleveland | | Troxell William C, 941 Hamilton St | Radiology |
| Betschelheim Frederick 1020 Huron Rd | Radiology | Altoona | |
| Farmer H L, 10515 Carnegie Ave | Radiology | Alleman George E, 1410 12th Ave | Roentgenology |
| Freedman Edward F, 25 Prospect Ave NW | Roentgenology | Bliss Gerald D 1220 13th Ave | Radiology |
| Hill W C 10515 Carnegie Ave | Radiology | Ashtabula | |
| LeFevre, Walter J 9400 Euclid Ave | Roentgenology | Mulligan P B | Roentgenology |
| Mahrer H A, 10515 Carnegie Ave | Roentgenology | Bethlehem | |
| May Raymond V, 10515 Carnegie Ave | Radiology | Leibert, H F, 338 Wyandotte St | Roentgenology |
| May Robert J, 10515 Carnegie Ave | Radiology | Chester | |
| McCoy Charles C Lakeside Hospital | Roentgenology* | Egbert Walter E, 601 E 13th St | Roentgenology* |
| McNamee Edgar P 25 Prospect Ave NW | Diagnostic roent. | Sharpe, A Maxwell 708 Sproul St | Roentgenology* |
| Nichols, B H 2050 E 93d St | Radiology | Clearfield | |
| Osmond John D 10515 Carnegie Ave | Radiology | Reiley W E | Radiology |
| Portmann U V Cleveland Clinic | Roentgen therapy | Coatesville | |
| Steel David Lakeside Hospital | Roentgenology | Perkins, J A 367 Chestnut St | Diagnostic roent. |
| Thomas M A 10515 Carnegie Ave | Radiology | Danville | |
| Columbus | | Hawley S J | Roentgenology* |
| Bowen Charles F 332 E State St | Radiology | Dubois | |
| Means Hugh J 683 E Broad St | Radiology | Gann G W 49 E Long Ave | Roentgenology |
| Miller W H 328 E State St | Radiology | McCormick A F Maple Ave Hospital | Roentgenology |
| Reinert Edward G 350 E State St | Radiology | Easton | |
| Quincy James J 309 Bushkill St | Radiology | Quincy James J | Radiology |

THE MANAGEMENT OF RADIOLOGIC PRACTICE IN HOSPITALS¹

By D S BEILIN, M.D., Radiologist, Augustana Hospital, Chicago, Illinois

THE management of radiologic practice in hospitals is a very timely subject. This paper is not intended for those who are seasoned in hospital radiologic practice—I am sure there are many of you who are more competent to present this subject than I. However, I have been interested in this subject for some time, and the present paper is the result of observations and investigations, which have been made during the past five years. The ideas and facts presented have been effectively carried out in general hospital radiologic practice, during the same length of time. It is understood that no fast rules and regulations can be made, as many institutions have their individual problems. The size of the hospital, and the character of the practice, whether private or charity, as well as numerous other obvious factors, bear a definite relationship to the management of radiologic practice. In a relative, practical way the following aspects are of importance.

The department of radiology in a hospital is an integral part of the institution; it plays a rôle closely associated with the other departments. Harmony and compatibility in their interrelationships are of considerable importance in maintaining efficiency.

Personnel.—The director of the radiologic department must be a graduate physician, licensed to practise, ethical, in good professional standing, with sufficient clinical experience and, in addition, special training in radiology. If the volume of work is adequate, it is preferable that the director of the department be a full-time man. Small hospitals, not able to afford a full-time radiologist, should be encouraged to share the part-time services of such a person. The

small community with but one hospital will find it quite feasible for members of the hospital staff to pool their interests, and to select one of their number to make a special study of the subject, with a view toward directing the radiologic department. The radiologist should respond willingly to a call to the operating room, or to the bedside for consultation when necessary, for frequently he can be of considerable assistance. At all times the utmost co-operation between the radiologist and the medical staff should be maintained. The radiologist should be present at all clinical conferences, as well as at staff meetings. These views are in accord with those presented by the American College of Surgeons in the Manual of Hospital Standardization, and Hospital Standardization Report, for the year 1930. It is true that the radiologist has a referred practice, and should be considered as a consultant, but may I emphasize that if he expects to be considered as a consultant, he must so manage his department as to fulfill that status?

Radiologist's Compensation.—There is no strict uniformity in hospital practice in the manner of compensation for the services of the radiologist. We are all familiar with the various plans in practice. It is my opinion that the percentage basis of compensation for the services of the radiologist is productive of the best ultimate results to the hospital, its staff, its patients, and to the radiologist himself. The percentage basis gives the deserved reward for the maximum effort. Experience has taught that it is best to base the return on gross, rather than on net, income, chiefly because it obviates complicated bookkeeping and avoids misunderstandings, as well as resulting in happier attitudes. The percentage that the radiologist receives should be directly dependent upon

¹Presented before the Radiological Society of North America at the Seventeenth Annual Meeting, at St Louis, Nov. 30-Dec. 4, 1931.

RADIOLOGY

| Name and Address | Type of Service | Name and Address | Type of Service |
|---|-------------------|--|-------------------|
| Berumont | | Longview | Washington |
| Ledbetter, L. H., 388 Pearl St | Radiology | Hayes, Richard, 1267 Commerce Ave | Roentgenology |
| White, C M, 595 Orleans St | Roentgenology | Scitell | |
| Corsicana | | Bourns, Frank S, 509 Olive St | Radiology |
| Curtis, Richard C, 101 N Benton St | Roentgenology | Dwyer, Maurice F, 1115 Terry Ave | Radiology |
| Dallas | | Garnhart, March N, 1305 4th Ave | Radiology |
| Bever, N B, 1719 Pacific Ave | Radiology | Holtz, Kenneth J, 920 2d Ave | Roentgenology |
| Martin, Charles I, 1719 Pacific Ave | Radiology | Koenig, Carl E, 509 Olive St | Roentgenology |
| Martin, J M, 1719 Pacific Ave | Radiology | Nichols, H E, 1215 4th Ave | Roentgenology |
| Spanler, Davis, 4105 Live Oak St | Radiology | Snively, J. Howard, 509 Olive St | Roentgenology |
| Eastland | | Stephens, Lorenzo L, 1215 4th Ave | Radiology |
| Cotton, J H | Roentgenology | Thompson, H B, 1305 4th Ave | Radiology |
| El Paso | | Thomson, Curtis H, 1305 4th Ave | Roentgenology |
| Cathcart, J W, 114 Mills St | Radiology | Spokane | |
| Mason C H, 114 Mills St | Radiology | Aspray, Joseph, 407 Riverside Ave | Roentgenology |
| York M N, Bassett Tower | Roentgenology | Betts, Arthur, 407 Riverside Ave | Radiology |
| Fort Worth | | Wurd, Charles B, 407 Riverside Ave | Radiology |
| Bond Tom B, 600 W 10th St | Radiology | Tacoma | |
| Hyde A R, 600 W 10th St | Radiology | Fishel, C R, 740 St Helens Ave | Roentgenology |
| Jagoda, S, 1212 North St | Radiology | McCarty, E D, 740 St Helens Ave | Roentgenology |
| O Bannon, R P, 1028 5th Ave | Radiology | Walla Walla | |
| Houston | | Johannesson, C. J, 1 W Main St | Roentgenology |
| Durrance, Fred Y, 1215 Walker Ave | Diagnostic roent. | Yakima | |
| Harris, C P, 1625 Main St | Roentgenology | Cornett, George W, 321 E. Yakima Ave | Roentgenology* |
| McDeed, W G, 1215 Walker Ave | Roentgenology | Charleston | |
| McHenry, R K, 1215 Walker Ave | Roentgenology | Lambert, A C, 240 Capitol St | Roentgenology |
| Sauermann, William O, 804 Travis St | Roentgenology | Fairmont | |
| Lubbock | | Francis, Charles T, Cook Hospital | Roentgenology |
| Smith, Jerome H, Lubbock Sanitorium and Clinic | Radium therapy | Hollidays-Cove | |
| Mineral Wells | | Davis, George H | Diagnostic roent. |
| Yeager, Robert L | Roentgenology | Huntington | |
| Orange | | Mackenzie A R, 955 4th Ave | Roentgenology* |
| Barr, Richard E | Radiology | Vinson, L T, 317 9th St | Roentgenology |
| San Antonio | | Parkersburg | |
| Barron, William Marshall, 705 E Houston St | Roentgenology | Boice, Ralph Homer, 717 Ann St | Roentgenology |
| Hamilton, W S, 705 E Houston St | Diagnostic roent. | Rose, Lonzo O, 510 1/2 Market St | Radiology |
| Lowry, R H, Jr, Station Hospital Fort Sim Houston | Roentgenology | Wheeling | |
| Ostendorf, W A, 507 1/2 E Houston St | Roentgenology | Buppus, E S, 77 16th St | Roentgenology |
| Sherman | | Clovis, C H, Ohio Valley General Hosp | Radiology |
| Henschien, G E, 500 N Highland Ave | Roentgenology* | Kahlfleisch, W K, 58 16th St | Roentgenology |
| Temple | | Quimby, Will A, 1401 Market St | Radiology |
| Ciles, Roy G, Scott and White Clinic | Roentgenology | Appleton | |
| Powell, Eugene V, 304 S 22d St | Radiology | McGrath, E F, 114 W College Ave | Radiology |
| Wilson, R T, Scott and White Clinic | Roentgenology* | Beloit | |
| Waco | | Wilson, Russell F, Beloit Municipal Hospital | Radiology |
| Jenkins, I Warner, 425 Austin Ave | Radiology | Eau Claire | |
| Wichita Falls | | Baird, J C, 401 S Barstow St | Roentgenology |
| Wilcox, Clark A, 1300 8th St | Roentgenology* | Green Bay | |
| Salt Lake City | Utah | Olmsted, Austin O, 205 E Walnut St | Radiology |
| Coray, O B, 54 E South Temple St | Roentgenology* | Shewalter, G M, 305 E Walnut St | Roentgenology |
| Kerby, James P, 9 Exchange Pl | Roentgenology | Troup, R L, 306 Cherry St | Roentgenology |
| Burlington | Vermont | Janesville | |
| Caldwell, Nathan R, Mary Fletcher Hosp | Roentgenology* | Kuegge, F H, 19 S Main St | Roentgenology |
| Johnson, Carl F, 266 Main St | Roentgenology | Kenosha | |
| Wilson, S A, 150 Bank St | Diagnostic roent. | Dowing, Irwin E, 625 57th St | Roentgenology |
| Lynchburg | Virginia | Sokow, Theodore, 723 58th St | Radiology |
| Spencer, Hunter B, Allied Arts Bldg | Radiology | La Crosse | |
| Newport News | | McLoone, J E, 319 Main St | Roentgenology |
| Davis, R A, 2901 West Ave | Roentgenology | Madison | |
| Norfolk | | Litting, Lawrence V, 925 Mound St | Roentgenology |
| Eley, Clayton W, Hosp of St Vincent de Paul | Roentgenology* | Pohle, E A, 1300 University Ave | Radiology |
| Petersburg | | Sisk, J Newton, 16 S Henry St | Roentgenology |
| Clarkson, Wright, 30 Franklin St | Radiology | Marsfield | |
| Richmond | | Potter, R P | Roentgenology |
| Flanagan, E L, 116 E Franklin St | Roentgenology | Milwaukee | |
| Gray, Alfred L, 118 E Franklin St | Roentgenology | Altenhofen, A R, 152 W Wisconsin Ave | Roentgenology |
| Hodges, Fred M, 1000 W Franklin St | Radiology | Baumgartner, S, 205 E Wisconsin Ave | Roentgenology |
| Tabb, J Lloyd, 1000 W Grace St | Roentgenology* | Epperson, Paul S, 324 E Wisconsin Ave | Roentgenology |
| Talley, D D, Jr, 501 E Franklin St | Roentgenology* | Haobe, John Edwin, 231 W Wisconsin Ave | Roentgenology |
| Whitehead, L J, 501 E Franklin St | Roentgenology* | Podlasky, Harry B, 536 W Wisconsin Ave | Roentgenology |
| Roanoke | | Zmyslony, W F, 931 W Mitchell St | Diagnostic roent. |
| Armentrout, John F, 30 1/2 Franklin Rd | Radiology | Neenah | |
| McKinney, Joseph T, 30 1/2 Franklin Rd | Roentgenology | Greenwood, S D | Radiology |
| University | | Salem | |
| Archer, Vincent W | Roentgenology | Fletcher, William | Roentgenology |

form concept which may be generally applied

In the rules and regulations it should be definitely stated that the radiologist has entirely a referred practice. Each examination is considered a consultation, and the patient's charge is for the roentgen diagnosis, or a radiologic treatment. All reports and diagnoses are sent to the attending physician who has referred the case to the department. The patient will receive all information from his physician, thus maintaining the highest standard of medical ethics. The following rules and regulations for the radiologic department have been carried out efficiently during the past five years in the hospital of which I have most intimate knowledge.

Requisitions.—Every patient who is to have an X-ray examination is required to have a requisition made out for the examination in question by the attending physician, or by the interne on his service. Occasionally, requests are made orally to the supervisors on the floors, the attending physician being responsible for such orders. Requisitions must be completely filled out as to the following points. The patient's name, address, hospital admission number, clinical diagnosis, and the X-ray examination desired, stated specifically. All requisitions must be brought to the X-ray department before an examination can be made. The patient's hospital record must be brought to the X-ray department with him. The patient's name, address, name of attending physician, hospital case number, room number, X-ray admission number, the specific type of examination requested, and the charge for the examination, are all entered in the record book of the department. The patients are examined and instructed in detail regarding their orders. Requisition slips made out on Sundays, holidays, or outside of the regular hours of the department for examinations, should be placed either in the X-ray department or left with the clerk

in the admission office. The clerk in the admission office either sends the X-ray requisition to the department in the morning, or notifies the resident in the department or one of the technicians on call. The former, who resides in the hospital, may be consulted whenever necessary.

Hours of Service.—In any consultation practice the consultant is on call at any time. However, in radiologic practice in hospitals it is customary that the department be open when service is usually desired. Such hours are customarily from 8 A.M. to 5 P.M., with the exception of Sundays and holidays. It is not essential that the radiologist be available during the entire day, as the routine work is carried on by the assistants in the department. However, the services of many full-time radiologists are available from 9 A.M. to 5 P.M. Examinations desired outside of the regular hours may also be had by appointment.

Emergencies.—The urgency of the patient's symptoms alone constitutes an emergency. Emergencies will be given preference over regular routine work. Emergencies outside of the regular hours will be taken care of either by the resident or by one of the technicians on call. If necessary, communication should be had with the director of the department.

Ownership of Roentgenograms.—The question of the title in roentgenograms, so far as I have been able to ascertain, has not been decided upon by the Appellate or Supreme Court of Illinois. There are innumerable decisions on the use of films but the ownership is a question that, as far as I can find, has not reached the higher courts. It is basically a matter of contract, and comes under the same conditions as cover photographs and negatives. The law in the case of photographs is more or less settled, and there seems to be no question but that, in the absence of contract existing between the photographer and the subject, or the one engaging his services, the prints and nega-

the size of the institution, and the amount of work done, for instance, if a radiologist is in a small institution he should receive a larger percentage of the gross income. It should be borne in mind that, as a rule, the amount of work done is usually directly proportional to the ability of the radiologist in the department.

It is unfortunate that many physicians are insufficiently and inadequately taught on the subject of radiology in medical schools. It would appear that their chief enlightenment as to the real clinical importance and value of radiology commences with their hospital experience, and, therefore, it is usually a departmental program of education, instead of one which should have been given years before in the medical schools. This phase of the question is of the utmost importance, as, not infrequently the secret to success of a radiologic department in a hospital is directly dependent upon the enlightenment of the attending men in the institution. I feel fairly safe in saying that the physicians obtaining value received in clinical information from their radiologist will insist that their patients have the necessary radiologic work.

Resident in Radiology.—In an institution of two hundreds beds or more, it is advantageous, as well as advisable, to have a resident in radiology. The resident should be a qualified physician who has an accredited internship, and, if possible, some clinical experience, and particularly one who is desirous of specializing in radiology. The resident should have specific duties as well as regular services, and should be in charge of the department during the absence of its director. The hospital should provide full maintenance. The duties and services of the resident should embrace all branches of diagnostic work and as much therapeutic as the equipment of the hospital permits, so that on the completion of his service he shall be well qualified to set out in the field, either as an assistant in a large hospital or as a radiologist in a small organization. It

would be well if the small community hospital which cannot afford the services of a seasoned radiologist would engage a resident in radiology on the completion of his services. This would enable the smaller institutions to have a better qualified service, as well as affording the beginner in radiology an opportunity for further experience and knowledge.

X-ray Technicians and Assistants.—It is important and preferable that X-ray technicians be somewhat familiar with clinical medicine as well as with nursing care. This type of work is particularly suitable for graduate nurses. This statement, however, does not imply that only graduate nurses are capable of doing this particular type of work. It is always an advantage to a radiologist to select certain nurses in his institution, and to train them in the technical and routine aspects of radiology. The training of X-ray technicians is a very important subject, as well as a controversial one. It is the experience of many that an intelligent nurse who is properly trained, usually makes, in approximately one year an excellent radiographer, as well as an assistant in the department. The radiologist's secretary should be carefully selected and properly trained, in order to avoid errors which may result in serious circumstances.

Rules and Regulations Governing the Radiologic Department.—It is of paramount importance that rules and regulations governing the radiologic department be specifically stated and typewritten, and sent to the superintendent of the hospital, the superintendent of nurses, the attending physicians, internes, and supervisors of nurses on every floor, and be made available for the guidance of special and general nurses on duty. I know of no other practice which simplifies the management of radiology more effectively than this one. It is time that there should be some sort of consistency in these rules and regulations in hospital departments. A study of this phase of radiology by a special committee may result in a uni-

Old Films—Requests for old films (that is, for films more than four months old) should be made one day in advance if possible. When a large number of films is desired for study, lantern slides, etc., a notice of several days should be given. It is important that the rule for the removal of films from the hospital be adhered to.

Roentgen Reports—Reports of examinations are sent to the attending physician on the same day, if the work is completed and if time permits, otherwise, the report is sent the following day. Reports of examinations requiring several days are sent immediately upon completion of the work. In all house cases a report is sent to the attending physician, one is placed on the patient's chart, and a copy is filed in the X-ray department. The attending physician may also receive a report of a case over the telephone. It is always preferable that reports be sent when the examination is completed.

Examination of Films by the Attending Physicians—Films may be seen preferably in the X-ray viewing room in the afternoon, however, if necessary, they may be seen at any time during the regular hours of the department. If films are desired outside of regular hours, an appointment should be made with one of the personnel of the department. Physicians may consult the radiologist at any time, however, the afternoon is preferable.

Unsatisfactory Films—Films which are technically unsatisfactory will be retaken, and a request to have the patient return will be noted on the report. In such cases a requisition marked "retake" should be sent. The patient will then be called to the X-ray department in the usual manner.

Photographs, Lantern Slides, Prints, etc.—These are made by a competent photographer, requisitions for such work being properly filled out, stating specifically what is desired, etc. Unless otherwise stated the bill for such work will be rendered to the physician requesting it.

Attending Physicians, Internes, Nurses, and Employees, Desiring Radiologic Work—Such are examined without charge. Internes, nurses, and employees are required to have a requisition filled out for the examination in question by one of the attending physicians. Outside physicians desiring personal radiologic work are given a discount of 50 per cent.

Management of Radiologic Examinations—Complete instructions for the management of all roentgenologic procedures are given in the rules and regulations governing the radiologic department. It is a general rule that the orders for all roentgenologic examinations are received from the roentgenologic department. For example, in all examinations of the gastro-intestinal tract the previous orders are automatically suspended, and the regular roentgenologic instructions for said examination are adhered to.

Identification of Roentgenograms in Court—As a general rule of law roentgenograms can be identified only by the person who took and developed them. In some jurisdictions this is not as strictly held to as in others, permitting, at times, the head of the department, who is thoroughly familiar with the routine, to testify. However, in any event, the plates are not admissible as evidence unless properly identified, proper identification meaning the qualifying of the technician as an expert in his or her profession. On this point I am also advised that, once a subpoena is issued from any court of record, having jurisdiction over the technician, to appear in court with the roentgenograms, and he does not appear, he is, of course, subject to contempt proceedings. However, courts as a rule are disposed to be considerate of the technician, knowing that the nature of his profession is such that he cannot always appear when called. If it is very inconvenient or impossible for the technician to testify at the certain time set forth by the court, he may often arrange in ad-

tives belong to the subject. Of course, there is a custom of the photographers to retain negatives on orders for prints, but this custom has never given them title to the negatives, and, even if they have title, it is merely to the physical thing and not for its use for any purpose not permitted by the subject. In the matter of roentgenograms, the same law should logically apply. The fact that the roentgenograms are pictures of parts of the body seems to bring them within the category of photographs. The mere fact that they are taken in hospitals to determine a diagnosis should not change the relationship between the patient and the radiologist. It is, however, feasible and practical for the hospital to so arrange its routine with the patient as to have undisputed claim to the physical plates, or even to their promiscuous use. This can be done by a simple agreement on the face of the requisition for the X-ray work desired, signed by the patient at the time the roentgenograms are taken. In substance it can be stated as follows:

"All services rendered and billed for by the radiologic department shall be for roentgenologic diagnosis or for radiologic treatments, it being understood that the hospital retains title and ownership for all purposes to the physical plates developed."

This, however, is not very practical, although in certain instances it is preferable. It may be more to the point to have printed on the requisition slip, as well as on the bill and receipt submitted to the patient, the following:

"All services rendered and charges submitted by the radiologic department shall be for the roentgenologic diagnosis, it being understood that the hospital retains title and ownership for all purposes of the physical roentgenograms developed."

The mere posting of a notice to such effect in the radiologic department might also be effective if specifically called to the attention of the patient at the time.

Use of Plates.—The law is fairly well

settled that, regardless of contract or conditions, a patient has a right to subpoena from the institution all records necessary in any litigation that he may have as a result of injury sustained, in instances in which the records are pertinent to the issue in litigation. He can invoke this right by a subpoena *duces tecum*. The courts have held that, even in cases in which the hospital bill is not paid, the patient can avail himself of this right.

Removing Films from the Hospital.—It should be specifically understood that the patients pay for the roentgen diagnosis. The films are the property of the institution, and a part of the permanent record. Films may be removed from the hospital temporarily or permanently with the permission of the attending physician. If the attending physician does not wish to have the films removed, the patient may have prints made from the films at a nominal cost. When films are removed from the hospital, copies of them are placed in a "preserver" which is marked on the outside "property of the hospital" and the original "preserver" is kept on file.

Individuals, other than the attending physician and patient, desiring to remove films from the hospital, or to obtain reports. Attorneys, insurance adjustors, and other physicians, desiring to remove films from the hospital, or desiring to see roentgen reports of cases in question, may do so only with the permission of the attending physician on the case.

Removing Films from the X-ray Department.—Upon application to the secretary in the office in the X-ray department, films may be taken after they have been interpreted. Occasionally, films may be removed before interpretation, such films being returned as promptly as possible. Films needed in the operating room or in other departments may be sent for or delivered, but must be returned immediately after their use.

down in writing I ask for the *problem*. You do not send a boy into the basement to take a look at the basement. You send him down to see if a window is open, if the fire is burning in the furnace, if a prowler is there. You give him some reason for going.

So I adopted the practice of writing down the problem in my report. For instance, "The patient has an afternoon temperature, cough, etc," if it is a question of lung examination, or I note if the patient has hemorrhage, or certain symptoms after meals, and so forth. You would be surprised to see how, since I have adopted the scheme of stating the problem, the staff has really gone to a great deal of pains to write out a statement of the problem in the language they would like to see in typewritten reports. When no problem has been stated, I take pains to say, "The requisition failed to state the problem." It has been very helpful. I do not know why I did not think of it long ago.

I note the question of the practice of roentgenology in hospitals has been brought up. It is an economic problem about which we should do a great deal of thinking. Hospitals are hiring doctors to practise roentgenotherapy. They are hiring the radiologist to carry on not only the radiologic practice of the hospital, but they are opening the doors of the hospitals to anyone from outside practice who wants to come in to have radiologic work done.

That can lead to only one thing. It is absolutely in line with the practice that is gaining headway in a good many parts of the country of hiring a radiologist to do certain work, letting the hospital make and collect the fees. It is only the opening of the door to the time when they will hire a surgeon on salary to do the emergency work and let the hospital make the fees and collect for that emergency work. Then they will have somebody hired to do the emergency medical work. It is only a question of time until there will be a practising of medicine by the hospitals.

As to identification of films in a legal case in which the technician has left employment and cannot be located in one such case, by identifying the teeth which happened to show in the film, we were able to prove that it was the film of that particular patient.

I would like to state that, in going upon the stand to testify, I do not qualify myself as a radiologic expert. I qualify myself as a physician who is expert in radiology. One of my colleagues almost got into trouble for contempt of court, because, when he was first put on the stand, he neglected to state in his qualifications that he was a physician and that he practised medicine. They had him up there as a "picture taker." It serves some of us right to be put up as such, when we continue to talk about "pictures."

DR. S. A. CLARK (South Bend, Ind.) I just want to correct one statement that the essayist made in regard to the question of the courts having passed upon the ownership of the films.

In last week's (Nov. 21, 1931) issue of the *Journal of the American Medical Association* appeared this article "The question of whether the roentgenograms of the hospital patient belonged to the patient or to the hospital was answered by a court for the first time, so far as is known, in Hurley Hospital vs. Gage, decided on appeal April 21 by the Circuit Court of the County of Genesee, Michigan. In giving judgment the court pointed out that the hospital sold and the patient paid for, not the material that went into roentgenograms, but knowledge and experience. The protection of the hospital might depend largely upon the proper preservation of the roentgenograms, and, said the court, 'the films should remain with the hospital.' Judgment was given against the patient for the balance due on his bill."

DR. S. C. BARROW (Shreveport, Louisiana) I want to speak strictly from one angle, and what I say will be really more a discussion of Dr. Case's discussion than of the paper.

In all branches of medicine I think we realize that we need have no fear for future scientific development so long as the medical profession is permitted to manage its business as it, and it only, knows how it should be managed. That is applicable to the various specialties in medicine.

Personally, I have never seen the right, or the justness, or the appropriateness of the

vance, a suitable time for the taking of testimony

Expert Testimony—The average physician finds himself at a great disadvantage when he is called upon to appear in court as an expert witness. There are excellent articles on the medical expert witness so I shall touch on only a few important aspects. Frequently, in cross-examinations, attorneys seek to embarrass physicians by putting questions framed in such a way that the answers, if given as requested, would be only partial statements of the facts, disconcerting to both the doctor and the side for which he is testifying. The best way to meet this situation is to appeal frankly to the court upon the theory that the question as stated, or framed, cannot be answered fairly. If the court rules in favor of the cross-examining attorney, the doctor is compelled to answer. However, as a rule the court allows a good deal of latitude to save a physician in such a situation.

This does not apply in cases in which the cross-examining attorney is asking a question for the purpose of impeachment. The mere fact that a physician does not want to answer a question is no excuse. As sometimes happens, he has given testimony on direct examination, and under cross-examination reverses himself. The thing to keep in mind is that every cross-examining attorney seeks to do one thing with the physician who is not testifying for his side—to discredit his testimony as an expert. Often when roentgenograms are put in evidence the meaning of a certain mark, line, or density upon the roentgenogram comes into issue and it is not unusual for one group of physicians to interpret the line, mark, or density as significant, while the other side attaches no meaning to them whatsoever, or construes them as normal findings. This is solely a matter of opinion. The jury usually leans towards the decision of the doctors making the best impression. This impression is gathered both from the demeanor of

the physician on the stand and his experience in his given field, as brought out by the evidence. Sadly enough, the weight of such testimony has very little to do with the actual facts.

In conclusion, may I state that I appreciate the diversity of viewpoints on the subject of the management of radiologic practice in hospitals, and have presented those aspects which have been proved by practice during the past five years.

DISCUSSION

DR JAMES T CASE (Chicago, Ill.) It seems to me that Dr Beilin has admirably stated a manual of practice for the hospital in which he is engaged. Unfortunately the circumstances attending his practice are not duplicated in all hospitals. Evidently as the out-growth of a good deal of thinking and collaboration with the physicians of the staff, he has been able to bring about a rather satisfactory manual of practice such as that which he has presented.

First of all, we must satisfy the attending staff. They have a right to be satisfied, and if what they want is not reasonable, we cannot simply deny it; instead, we must endeavor to persuade them that there is a better way. According to the years of our personal experience and our relation to the staff, we will have more or less success in getting them to see things as we want them to be seen.

As for requisitions for roentgen work, I think the problems should always be stated. I have recently hit upon a very effective, and yet simple, means of getting the staff members to state the problem they wish studied roentgenologically. I became tired of having men send in patients for "gastro-intestinal examination" or "colon," or "sinuses," or some other vague request. Therefore, I kept asking the superintendent to send out instructions that the attending men should give us the problem for the solution of which they send patients to the radiologic department. I long ago ceased to ask for a tentative diagnosis because the average man is afraid to put it

financial arrangements with the hospital concerning the necessary free work

The hours of service were well enough put, but in the matter of emergencies it seems to me that it is not a sufficient service merely to provide a technician. That is a duty for the radiologist himself to perform, I believe.

DR BEILIN (closing) Irrespective of opinion, the subject is very important. One hears numerous complaints from physicians who are practising in general hospitals.

The first point that I wish to emphasize again is that the radiologist should impress on the attendants in the institutions in which he is practising, by his conduct and by the management of his practice, that he is not a roentgen photographer, but a consultant. Therefore, the roentgenologist should consult whenever possible with every attending physician who comes to see him in his department. He should, as Dr Case has stated, desire to find out what the problem is. He is not interested merely in the examination of the chest or of the gastro-intestinal tract. He is interested to see if he can be of help in eliciting a diagnosis, because diagnosis is the primary idea of the physician who is referring the case.

In regard to the question of requisitions, I feel the idea expressed by Dr Case is an excellent one, but in institutions in which one has a fair amount of work, it is important that one shall have a standard form of requisition. Our reason for demanding specific statements in filling out requisitions is to avoid errors in examinations.

We take a history of every patient who comes into our department, because we want to know something about the clinical condition of that patient. We do not care particularly what he is going to be examined for. We want to try to make a diagnosis of what he is complaining of.

We take the history for two purposes first, to be familiar with the clinical complaint, and, secondly, to see if the examination which is requested will elicit the complaints of the patient. If the doctor has ordered a gastro-intestinal examination, and if we find the gastro-intestinal tract is normal, we may then

advise an examination of the genito-urinary tract, if the clinical symptomatology indicates

DR NEWELL Who takes the history of the patient?

DR BEILIN The resident in the department, or one of the nurses. My technicians, who are all nurses, have been in my department for many years, and some of them are able to take a history as well as some physicians.

The assistants in the department study a set of questions pertaining to various clinical conditions which come to the roentgenologic department. At the beginning, the nurse refers to the typewritten questions relating to a certain examination. After a while she becomes familiar with all the cardinal symptoms pertaining to a certain disease so that a trained nurse in one's department is able to take a fairly competent history.

I agree that the size of an institution will present an individual problem. One must also take into consideration the fact that a roentgenologic department may have been inadequately managed before one has taken charge of it. The new director's first problem may be to straighten out the situation. It should be emphasized that the roentgenologic department is the roentgenologist's problem. It should be borne in mind that superintendents of hospitals have their own problems, and, as a rule, they are going to try to manage the entire institution as they see fit. In handling the professional and business administration of my department, I make it my business to know what the superintendent of the institution and board of trustees have in mind and what they expect.

In regard to the statement made by Dr Clark, I am familiar with what happened in the State of Michigan. I have that little extract before me, but I was speaking about jurisprudence in the State of Illinois.

I also agree with what Dr Newell has said about emergency examinations in particular. But I cannot agree with the point that, when an individual is sent in by an attending physician say at 10 or 11 o'clock at night, with a fracture, the director of the department should

American College of Surgeons' standardizing the X-ray department of a hospital, any more than I have seen the appropriateness of the American College of Physicians' doing it I was glad to see that the American Medical Association, which is really the one to control this standardization, has taken at least a step in that direction

Personally I am here to suggest that organized radiology take over the standardization of radiologic practice in hospitals I believe that the time has come and really passed, when we should do it for organized radiology of America At least it would be more appropriate that radiology do so than any other organization which has undertaken it

It is a notorious fact (and I am speaking now from direct knowledge) that over the whole country there are hospitals in which the X-ray department is being operated by a radiologist who is operating directly in competition with himself

That is a situation which cannot be overcome unless someone else than ourselves overcomes it There are numbers of men who cannot disconnect themselves from the hospitals for financial reasons Because of that, they have to submit to a financial situation which is embarrassing to say nothing of unethical I mean that certain hospitals in this country are using the X-ray department, reducing fees, or giving a schedule of fees which the same operator of that department cannot put into effect in his office The hospitals are using the X-ray departments because it is appealing to any industrial organization to be told, "We will give you your X-ray services for 50 per cent of what is usually charged" They know they are going to make up the low cost in another department

I do not charge those hospitals with directly violating their consciences as they see the situation You and I operate that department when the hospital has a contract with corporations to do their work for a fee that we cannot charge in a private laboratory, because we have no other means of charging that patient and the hospital has

Therefore, I feel very strongly that organized radiology should take this up, and, if it

does not, the situation is going to continue to grow worse I do not think, as Dr Case said, that there will ever be any chance of a hospital employing a surgeon and in that way removing the surgeons from private practice The surgeons are not going to stand for that We need not look to it.

As concerns the contacting of the local representative of the American College of Surgeons, who standardizes or reports on conditions, we cannot do that That is a too round-about way, and each man is attending to the business to which the organization should attend It is a deplorable situation and an unethical one It is a situation that we should get from under as quickly as possible I hope that organized radiology will come forward and assert itself and take action in the business that is its own

DR R R NEWELL (San Francisco, Calif.)
The ideal is for us to be consultants, and, if we are going to be consultants, we must act as consultants One of the best ways to train our physician friends to treat us as consultants is to be available, and also to use the telephone

It seems to me that our official relation to the hospital ought to be, as nearly as possible, the same as that of the other physicians and surgeons If the surgeons in the hospital have their own private practices, and if the physicians in the hospital conduct their own private practices, then the radiologists should be conducting their private practices in the hospital I admit that it is financially difficult, because the radiologist feels that he cannot, in a good many cases, afford to install expensive apparatus in the hospital Nevertheless, the most dignified relationship between the radiologist and the rest of the medical profession is that in which the radiologist is exactly on the same financial and professional basis as others in the profession A salary does not afford that, and a percentage arrangement does not afford that in the highest degree possible I know several radiologists who have decided that radiology is well conducted in a hospital They conduct their private practice in the hospital and have

THE RADIOLOGIST AS A CONSULTANT¹

By JOHN F HERRICK, M.D., F.A.C.S., F.A.C.R., OTTUMWA, IOWA

IT should be the aim of the radiologist to be considered a consultant in medicine

Too often he has accepted the rôle of technician, permitting his knowledge of medicine and surgery, as well as his knowledge of the science and art of radiology, to be submerged. His duty should not end with a simple report of structural findings. He should be able to analyze the findings in the light of the history and symptoms, to correlate them, and then give his conferee an opinion of practical value.

The radiologist has to do with two classes of physicians (*a*) those who do not desire an opinion from him, and (*b*) those who are desirous of obtaining any aid possible.

In the first class are those who, because of opportunity and experience, feel that they are quite competent to interpret the findings themselves. To them, the radiologist is little more than a technician. Others seem so jealous of their prerogatives that they undertake to make their own interpretations and diagnoses, notwithstanding their want of knowledge of the science of radiology. This class is hopeless. It is just as well to allow them, with the help of the technician, to make what they can of their work.

The second class, those who are conscious of their limitations, realize that they are not so well qualified to interpret fluoroscopic findings or X-ray films as those who make a special study of radiology. If the radiologist is to be a helpful consultant to this group, he must be able to interpret his findings in the light of physical conditions and physiologic variations, and to discuss them with his conferee as would a consulting physician or surgeon. Not until then may

he hope to take the place in medicine that rightfully belongs to him.

It is not an uncommon experience for the radiologist to be called upon to explain his findings. If he is well informed in medicine and surgery, he will be able to put the matter in such form that the physician may grasp its significance and apply it in the management of the case.

For instance, a patient is sent to the radiologist to seek for the cause of distressing abdominal symptoms. The radiologist finds no evidence of organic disease of the gastrointestinal tract. He sees a normally filling and emptying gall bladder, etc., but he does find a spastic colon which interferes with the normal function of that organ. A careful search having failed to reveal an organic cause, it becomes apparent that the etiology of the condition must be neurologic. Such cases are not uncommon; they are the source of grief to the attending physician. We see a number of such cases that, after going through some of the best known clinics, are sent home with a negative diagnosis to bring added woe to the home doctor. If the radiologist who handled the case were versed in physiology, he would be able to explain the nature of such a case to the referring physician and to suggest the possibility of securing relief by the prolonged and persistent use of belladonna, nux vomica, and cascara. The radiologist might make of the suffering, wretched patient, a happy, useful citizen, and win the gratitude and good-will of the attending physician.

A similar case may be made out for the gall bladder. A sense of gaseous distension, epigastric distress, and numerous other symptoms are the occasion for a radiologic examination of the gall bladder and its function. With such marked symptoms, often

¹Read before the Radiological Society of North America, at the Seventeenth Annual Meeting, at St Louis, Nov 30-Dec 4, 1931.

interpret the findings for the physician at that time. If the attending physician is not familiar with the roentgenologic interpretation of bones, the roentgenograms can well be interpreted the following morning. We do not allow any of our assistants, except a physician who is the resident in the department, to make an inter-

pretation of an examination in the absence of the roentgenologist. Many cases said to be emergencies are not. If one has reasonable rules for handling emergency cases, it will be unnecessary for his assistants to make roentgenographic examinations at all hours during the night.

Growth of Cancer-like Chicken Tumor Checked by Dyes—Scientists who have been studying chicken tumors in the hope of throwing light on the problem of cancer in man have for the first time been able to destroy the activity of one of the chicken tumor-producing agents by means of dyes, it appears from a report of Dr Margaret Reed Lewis and Warren Reed Lewis, of the Carnegie Laboratory of Embryology, Johns Hopkins Medical School, to the *American Journal of Cancer*.

Dyes are now used by some scientists to kill certain disease-causing organisms, such as the streptococci, and recently dyes have been tried in the treatment of cancer, although unsuccessfully. The Baltimore investigators wondered what the effect of dyes would be on chicken tumors. Viruses have been the subject of intense investigation in recent years, but so far it has been almost impossible to destroy the activity of any virus by a dye as can be done for larger, microscopic organisms. It is not known whether the virus is a living organism or a chemical substance.

The Lewises extracted the virus from one of these chicken tumors so they could work with it in a test tube. They combined it with eighty different dyes. After being mixed with

the dye, the virus was injected into the chicken to see if it could still produce a tumor. Two of the eighty dyes destroyed the tumor-producing activity of the virus. However, the investigators pointed out that the activity was destroyed in the test tube by an amount of dye which would be impractical to inject directly into the animal in the hope of destroying the tumor-virus in its body.

They consider eighty dyes a small number to have investigated. They feel from the results of their study that when a larger number of dyes are investigated, it may be possible to find more than two which can prevent the growth of tumors even when used in more dilute concentrations. Experiments on injecting the dye directly into the chickens suffering from this type of tumor are now being planned.

The world of science is already familiar with the studies of cell growth and cancer on which Dr Margaret Reed Lewis has collaborated with her husband, Dr Warren H Lewis, and it is interesting to note that in this latest investigation she had the assistance of another member of her family, her son, Warren Reed Lewis, now a medical student—*Science Service*.

primarily with the object of helping the patient to get well

In doing that, we must be careful not to give the clinician orders, in other words, we must not assume the direction of the case I mean, when we make an examination of the patient, it is our duty to describe our findings or give a record of our observations—what we observe in the roentgen examination, fluoroscopically and from the film findings—and then, distinctly separated from it, our interpretation in the light of the clinical knowledge which we have concerning that patient

I have frequently said that a condition may be due to this, or that, or that there are two, three, or four possibilities in the case which must be further interpreted in the light of clinical evidence at hand If I had some of that clinical evidence, I would say that such and such evidence would point to Number 1 as the most likely cause of the condition I even go further If I have in mind anything that will be helpful in getting the patient well, I believe it is my duty as a radiologist to make any suggestion The man in charge can throw away all my advice if he chooses

Gamma Rays and X-rays Have Different Effects—More exact knowledge of the differing biological effects of radiations used in treating tumors and other diseased conditions was urged upon medical experimenters and practitioners by Dr G Failla and Dr P S Henshaw, of Memorial Hospital, New York City, in speaking before the American Association for the Advancement of Science They described a series of experiments in which they tested the effects on various living things of equal-energy doses of X-rays and gamma rays from radium The effects tested included the extent of slowing-down of wheat seedlings, percentage of killing in insect eggs, and degree of skin erythema

In one series of "shots" it was found that parallel doses of X-rays and of gamma rays slowing down the growth of the shoot of

wheat seedlings to the same extent had different slowing effects on other parts of the plant and on other objects The gamma rays were 29 per cent more effective than the X-rays in slowing down root growth and 36 per cent more deadly to insect eggs, but they were 57 per cent less effective in causing artificial sunburn

This latter point is of some importance in practical medicine, for the effectiveness of a given dose of radiation on a tumor or other tissue under treatment is usually judged by the redness of the overlying skin But in the experiment the more destructive rays had the lower skin-reddening power, showing that unless the quality of radiation is taken into account the skin-reddening effect cannot be very closely relied on as an index to its other effects—*Science Service*

the gall bladder will fill and empty normally, again it may fill but fail to concentrate, or it may not be so much a failure in concentration as it is a failure of the liver to secrete the dye in the allotted time.

Such cases are often reported as diseased gall bladder when the disease is in the liver itself. Cholecystectomy fails to give relief, much to the embarrassment of the attending physician and surgeon. If the radiologist had in mind a correct history, if he had observed the coated tongue, foul breath, and muddy sclera, and had determined the extended time it took the liver to secrete the dye, all indications of a diseased liver, such a suggestion to the attending physician might prompt him to a course of treatment which would greatly benefit the patient, and, if surgery was necessary, lessen the mortality.

The radiologist may be asked to find in the chest the cause of a persistent cough. There may be no other symptoms, and physical examination of the chest may fail to locate the cause. Perhaps X-rays may also fail to show evidence of disease of the lungs, yet the cough persists. It often happens that a careful follow-up examination will reveal chronic cholecystitis or hepatitis. In such cases, slight pressure over the gall bladder or heavy percussion over the right costal cartilages will provoke the cough. Branches of the vagus nerve, which supplies the gall bladder, also serve the bronchi. Irritation at one point may cause reflex action at another, so, in this lesion, one may find cough, asthma, etc., as a result of disease of the gall bladder. Another not uncommon result of gall-bladder disease is cardiac disturbance through the vagus connections. Relief of hepatic or cholecytic disease will, in many cases, do more to relieve irregular or rapid cardiac action than any treatment directed to the heart alone.

It may be said that some of the conditions mentioned have no connection with roentgenology. They have not, from the tech-

nician's point of view. But the medical roentgenologist, as stated above, must be a true and helpful consultant if he wishes to occupy the position in the profession which he should. In order to do this, he needs a full and comprehensive knowledge of general medicine and surgery, especially of anatomy and physiology. Equipped with this knowledge, without intruding himself on his conferees, he may become so valuable an aid that his services will be much more in demand, to the advantage of the patient and to the satisfaction of the physician in charge.

DISCUSSION

DR G E PFAHLER (Philadelphia, Pa.) I think the sooner we, as radiologists, place ourselves in the position of consultants, the better off we will be, the better off the patient will be, and we will be making real progress in medicine.

I have always considered myself a consultant. Occasionally I have met men who thought I had exceeded my limitations. But, unless we consider ourselves physicians first of all, and make our radiologic practice secondary or a part of that position as a physician, we degenerate very rapidly to the position of technicians.

In every one of our cases, it is our duty to add anything to the case, or any information to the referring physician, that will help to get that patient well. After all, the patient is sick, the patient wants help. If we have an idea that may be helpful to that patient, it is our duty to express it to the referring physician, but not to the patient, just as any consultant would do. Sometimes those suggestions will be of value in proportion to our knowledge of general medicine. Therefore, it is our duty, as radiologists, to learn just as much about general medicine as we can, to learn the general practitioner's problems. Because if the radiologist interprets those problems only in the light of our technical knowledge the general practitioner does not get the effect. We must interpret in the light of the practising physician and his problems, and

waves of very short wave length which are set up when the velocities of electrons are altered suddenly

According to the quantum theory of the nature of radiation, roentgen rays are particles of energy (quanta) travelling linearly at the velocity of light

Note "Roentgen rays" is preferred by medical authorities, but "X-rays" is in more general use by physicists. The wave lengths concerned are usually between 0.006 and 1.0 millimicron.

Secondary Roentgen Rays 75 10 010

Secondary roentgen rays are the roentgen rays emitted in all directions by any matter irradiated with roentgen rays

Scattered Roentgen Rays 75 10 015

Scattered roentgen rays are roentgen rays which, during their passage through a substance, have been deviated in direction and also may have been modified by an increase in wave length

Characteristic Roentgen Rays

Characteristic Spectra 75 10 020

Characteristic roentgen rays are roentgen rays having wave lengths determined by the atomic constitution of the object which emits, transmits, or scatters them

Fluorescent Roentgen Rays 75 10 025

Fluorescent roentgen rays are secondary rays whose wave lengths are characteristic of the substance which emits them

Cathode Rays 75 10 030

Cathode rays are streams of electrons emitted from the cathode of an evacuated tube normal to its surface, under the influence of an applied voltage

Note By suitable means they can be brought outside of the tube

Lenard Rays 75 10 035

Lenard rays are cathode rays which have passed outside the discharge tube

Positive Rays 75 10 040

(Canal Rays)
Positive rays are streams of positive ions travelling at high speed from the anode of a partially evacuated tube

GROUP 75—RADIOLOGY

Section 20—Physical and Industrial Applications

Radiometallography 75 20 005

Radiometallography is the radiography of metals

X-ray Crystallography 75 20 010

X-ray crystallography is the study of the arrangement of the atoms in a crystal by the use of roentgen rays

Filtration of Roentgen Rays 75 20 015

Filtration of roentgen rays is the absorption of some of the rays of relatively long wave length by placing in the path of the beam an absorbing medium such as copper or aluminum

X-ray Spectrum 75 20 020

X-ray spectrum is the orderly arrangement according to wave length of a heterogeneous beam of roentgen rays

Minimum Wave Length 75 20 025
(Quantum Limit)

Minimum wave length is the shortest wave length in an X-ray spectrum. It is definitely related to the maximum voltage applied to the X-ray tube in accordance with the Planck-Einstein quantum equation

Absorption Coefficient 75 20 030

Absorption coefficient is the ratio of the linear rate of change of intensity of roentgen rays in a given homogeneous material to the intensity at a given point

Half Value Thickness 75 20 035
(Half Value Layer)

Half value thickness is the thickness of a given substance which, when introduced in the path of a given beam of rays, will reduce its intensity to one-half of the initial value

GROUP 75—RADIOLOGY

Section 25—Medical Terms

Radiotherapy 75 25 005

Radiotherapy is the treatment of dis-

ELECTRICAL DEFINITIONS

Final Report of Subcommittee No 13—Radiology

of

SECTIONAL COMMITTEE ON ELECTRICAL DEFINITIONS

of

AMERICAN STANDARDS ASSOCIATION

February, 1932

Sponsor

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

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The following definitions are submitted by Subcommittee No 13, Radiology, and constitute a final report This is a revision of the original report circulated May 14, 1931, and printed in RADIOLOGY, October, 1931 page 800

GROUP 75—RADIOLOGY

Section 05—General Terms

Radiology 75 05 005

Radiology is the branch of science that relates to roentgen rays, radium rays, and other high frequency rays

Radiologist 75 05 010

Radiologist is a medical specialist in employing roentgen rays and/or radioactive substances

Roentgenology 75 05 015

Roentgenology is the branch of science that relates to the application of roentgen rays for diagnostic or therapeutic purposes

Roentgenography 75 05 020

Roentgenography is the art of producing roentgenograms

Radiography 75 05 025

Radiography is the art of producing radiographs

Radiation 75 05 030

Radiation is the radiant energy emitted

by an X-ray tube, by radio-active substances or by other sources

Roentgenogram 75 05 035
(Skiagraph)* (Skigram)*

Roentgenogram is a photographic record of the relative transparency of the various parts of an object to roentgen rays

Radiograph 75 05 040
(Radiogram)*

Radiograph is a record produced on a photographic plate, film or paper by the action of roentgen rays or radium

Note There seems to be no good reason for continuing the use of this word as here defined "Roentgenogram" and "curiegram" fully cover the two senses which are included in this definition

Fluoroscopy 75 05 045
(Roentgenoscopy)

Fluoroscopy is the use in diagnosis, testing, etc, of a fluorescent screen which is activated by roentgen rays

GROUP 75—RADIOLOGY

Section 10—Kinds of Rays

Roentgen Rays 75 10 005
(X-rays) (Rontgen Rays)

Roentgen rays are electromagnetic

*Deprecated

waves of very short wave length which are set up when the velocities of electrons are altered suddenly

According to the quantum theory of the nature of radiation, roentgen rays are particles of energy (quanta) travelling linearly at the velocity of light

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GROUP 75—RADIOLOGY

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(Half Value Layer)

Half value thickness is the thickness of a given substance which, when introduced in the path of a given beam of rays, will reduce its intensity to one-half of the initial value

GROUP 75—RADIOLOGY

Section 25—Medical Terms

Radiotherapy 75 25 005

Radiotherapy is the treatment of dis-

ease by the application of roentgen rays or the rays from radio-active substances

Roentgentherapy 75 25 010

Roentgentherapy is the treatment of disease by roentgen rays

Radiumtherapy 75 25 015

Radiumtherapy is the treatment of disease by the use of radium, radon, or its active deposit

Irradiation 75 25 020

(Raying)*

Irradiation is the application of roentgen rays, radium rays, or other radiation to a patient or other object

GROU P 75—RADIOLOGY

Section 40—Tubes

Discharge Tube 75 40 005

Discharge tube is a vessel of insulating material (usually glass) which is exhausted to a low gas pressure, and which permits the passage of electricity through the residual gas upon application of sufficient voltage

Note. The tube is usually provided with metal electrodes, but one form permits an electrodeless discharge with induced voltage

Gas Tube 75 40 010

Gas tube is a discharge tube which depends on the presence of residual gas in the tube for the supply of electrons

Vacuum Tube 75 40 015

Vacuum tube is a vessel of insulating material (usually glass) provided with metal electrodes, which has been so highly evacuated that the residual gas does not affect the current between the electrodes

X-ray Tube 75 40 020

X-ray tube is a device for producing roentgen rays, embodying (1) an airtight enclosure exhausted to the proper degree of vacuum, (2) a suitable electrode, forming the cathode, from which electrons are liberated, (3) a second elec-

trode electrically insulated from the first, forming the anode or target upon which the electrons impinge after being set in motion by the action of the applied voltage

Cathode-ray Tube 75 40 025

(Lenard Tube)

A cathode-ray tube is a discharge tube with a thin window at the end opposite the cathode to allow the cathode rays to pass outside

Geissler Tube 75 40 030

A Geissler tube is a special form of discharge tube for showing the luminous effects of discharges through rarefied gases

Note. The density of gas is roughly one-thousandth that of the atmosphere

Crookes Tube 75 40 035

Crookes tube is an early form of discharge tube devised by Sir William Crookes and used by him for the study of cathode rays

Note. The density of gas is roughly one-millionth that of the atmosphere

Hot Cathode Tube 75 40 040

Hot cathode tube is a vacuum tube in which the cathode is electrically heated (usually to incandescence) in order to increase the emission of electrons

Hot Cathode X-ray Tube 75 40 045

Hot cathode X-ray tube is a vacuum X-ray tube in which the electron stream is supplied by a heated cathode

Note. The cathode stream may be regulated by varying the current through the cathode filament

Target 75 40 050

(Anode) (Anti-cathode)*

Target is the electrode on which cathode rays are focused and from which roentgen rays are emitted. It is usually of a heavy metal such as tungsten

Cathode Dark Space 75 40 055

(Crookes Dark Space)

Cathode dark space is the non-luminous region which envelops and follows the

*Deprecated

outline of the cathode in a discharge tube at moderately low pressures

Negative Glow 75 40 060

Negative glow is the luminous glow which envelops the cathode in a discharge tube at moderately low gas pressures

Valve Tube 75 40 065

A valve tube is an electric valve consisting of a vacuum tube having for one electrode a hot filament

GROUP 75—RADIOLOGY

Section 45—Other Apparatus

X-ray Machine 75 45 005

X-ray machine is an assembly of electrical devices necessary to activate an X-ray tube and control its operation

X-ray Apparatus 75 45 010

X-ray apparatus is an X-ray tube and its accompanying accessories, including the X-ray machine

Electrostatic Generator 75 45 015

(Influence Machine) (Static Machine)
(Wimshurst Machine)

Electrostatic generator is a device which depends upon electrostatic action for the production of electric charges

Induction Coil 75 45 020

(Coil) (Spark Coil) (Ruhmkorff Coil)

Induction coil is a transformer with open magnetic circuit which is excited by an interrupted or variable current

Interrupter 75 45 025

[Break (of an induction coil)]

Interrupter is a device for interrupting the primary current mechanically or otherwise

Fluorescent Screen 75 45 030

Fluorescent screen is a sheet of suitable material coated with a substance which fluoresces visibly when roentgen rays, radium rays or electrons impinge upon it

Fluoroscope 75 45 035

(Roentgenoscope)

Fluoroscope is a device consisting of a

fluorescent screen suitably mounted, either separately or in conjunction with an X-ray tube, by means of which X-ray shadows of objects interposed between the tube and the screen are made visible

Intensifying Screen 75 45 040

Intensifying screen is a thin screen, coated with a finely divided substance which fluoresces under the influence of roentgen rays, and intended to be used in close contact with the emulsion of a photographic plate or film for the purpose of increasing the effect on the film

X-ray Spectrometer 75 45 045

X-ray spectrometer is an instrument for producing an X-ray spectrum and measuring the wave lengths of its components

Ionization Chamber 75 45 050

Ionization chamber is an enclosure containing two or more electrodes between which an electric current may be passed when the inclosed gas is ionized. It is commonly used for determining the intensity of roentgen rays and other ionizing rays

Penetrometer 75 45 055

(Qualimeter) (Radiosclerometer)*

Penetrometer is an instrument for indicating the hardness of roentgen rays

Dosage-meter 75 45 060

(Dosimeter) (Intensimeter)

Dosage-meter is an instrument designed to estimate the quantity of radiation, so as to determine the duration of exposure when using roentgen rays for therapy

Roentgenometer 75 45 061

(Roentgen meter) (Ionometer)

Roentgenometer is an instrument for measuring the quantity or intensity of roentgen rays

Oscilloscope 75 45 065

Oscilloscope is an instrument for making visible the presence and/or the nature

and form of oscillations or irregularities of an electric current

Note There are several different types of instrument serving this general purpose which have been designated by this name

GROUP 75—RADIOLOGY

Section 60—Characteristic Terms

Hardness 75 60 005

[Quality (of Roentgen Rays)]

Hardness is the attribute which determines the penetrating ability of roentgen rays. The shorter the wave length, the harder the rays and the greater their penetrating ability.

Hardness (of a gas tube) 75 60 010

Hardness is the degree of rarefaction of the residual gas

Note The higher the vacuum, the higher the voltage required to cause a discharge with a cold cathode, and hence the shorter the wave length of the resulting roentgen rays

Intensity (of Roentgen Rays) 75 60 015

Intensity is the attribute of a beam of roentgen rays which determines the rate of ionization of air at a given point, under the conditions stipulated in the definition of roentgen (See 75 60 025). It is expressed in roentgens per unit of time

Quantity of Roentgen Rays 75 60 020

(Quantity of X-radiation)

Quantity is the product of intensity and time

Note It should be clearly understood that quantity is used here in a sense different from that customary in other fields, such as radiant energy in general. It is not proportional to energy, but, rather, to the product of energy density and a coefficient expressing the ability to cause ionization

Roentgen

75 60 025

Roentgen is the international unit of quantity of roentgen rays adopted by the Second International Congress of Radiology at Stockholm in 1928. It is the quantity of X-radiation which, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimeter of atmospheric air at 0 deg cent. and 760 mm of mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current

GROUP 75—RADIOLOGY

Section 95—Not Otherwise Classified

Ionization 75 95 005

Ionization is the process by which neutral atoms or molecules become charged, either positively or negatively

Ionization Current 75 95 010

Ionization current is the electric current resulting from the movement of electric charges produced by the action of an applied electric field upon an ionized medium

THE EFFECTS OF ULTRA-VIOLET, X-, AND CATHODE RAYS ON THE SPORES OF *MUCORACEÆ*

By BASILE J LUYET, Sc.D., Rockefeller Institute for Medical Research, NEW YORK CITY

THE experiments about to be described are preliminary observations of the effects of X-rays, of cathode rays and of ultra-violet light upon the development and growth rate of spores of the fungus *Rhizopus migrans* + As such they form part of a study being carried out in this laboratory of the action of these radiations upon a variety of simple organisms

TECHNIC

The experimental arrangements for producing and measuring the radiations have already been described¹. The cathode-ray tube, of Coolidge type, was operated at a potential difference of 155 kilovolts. In these tests no estimation was made of the number of electrons striking the irradiated surface but the dose was roughly that used in earlier studies on bacteria. The soft X-ray beam, from a copper target tube, was filtered through thin nickel foil and consisted mainly of the Cu K α line ($\lambda = 1\ 537\text{ \AA}$). Its air ionization as measured at the surface of irradiation was 130 E.S.U. per second. Ultra-violet light of a single wave length was obtained with a powerful mercury lamp and a large monochromator. The approximate energies in the several beams used, as found from readings of a standardized thermocouple, were for 2,536 Å, 8 ergs/mm²/sec., for 2,652 Å, 9 ergs/mm²/sec., for 2,900 Å, 11 ergs/mm²/sec., for 3,132 Å, 48 ergs/mm²/sec. In all cases care was taken to have the intensity of radiation as uniform as possible over the exposed region. This was determined by the use of fluorescent screens and, more sensitively, by the requirement that the biological effects be the

same on different parts of the irradiated surface.

Before irradiation the original culture was inoculated to test tubes containing Coon's agar medium. After two weeks' growth at 22° C to insure that the only spores present were mature and resting, a suspension of them was prepared in the nutrient solution. The surfaces of Petri dishes poured with Coon's agar medium were inoculated with the suspension thoroughly shaken and stirred to break up the sporangia. Areas on these plates were irradiated as soon as the spore-bearing solution had dried into the agar. After incubation for 24 hours at 22° C, a count was made, under the microscope, of the total number of spores on a given area and of the number of those which showed growth. Similar counts upon unirradiated areas gave the percentage of cells which failed to develop under normal conditions. Applying this correction the survival ratios of Table I were obtained. At the same time estimates were made of the average length of mycelial growth 24 hours after different dosages with radiation. This was accomplished by drawing under known magnification and with a suitable eyepiece the mycelia of sprouted spores. Tracings of the resulting lines with the wheel of a planimeter then determined the total length of mycelium due to a given number of spores. Results of this count, averaged to give the mycelial length of one spore, are recorded in Table II and Figure 2.

DISCUSSION

The survival ratios with all three types of radiation give similar multiple-hits-to-kill curves when plotted on semilogarithmic paper (Fig. 1). Evidence for the progressive

¹R. W. G. Wyckoff and T. M. Rivers, *Jour. Exp. Med.*, 1930, **L1**, 921; R. W. G. Wyckoff, *ibid.* 1930, **LII**, 435; R. W. G. Wyckoff and B. J. Luyet, *RADIOLOGY*, December, 1931, **XVII**, 1171-1175.

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Ionization current is the electric current resulting from the movement of electric charges produced by the action of an applied electric field upon an ionized medium.

SUMMARY

Spores of the fungus *Rhizopus nigricans* have been irradiated with cathode, X-, and

ultra-violet rays. Survival ratios with each type of radiation give curves which indicate that more than one hit or quantum absorp-

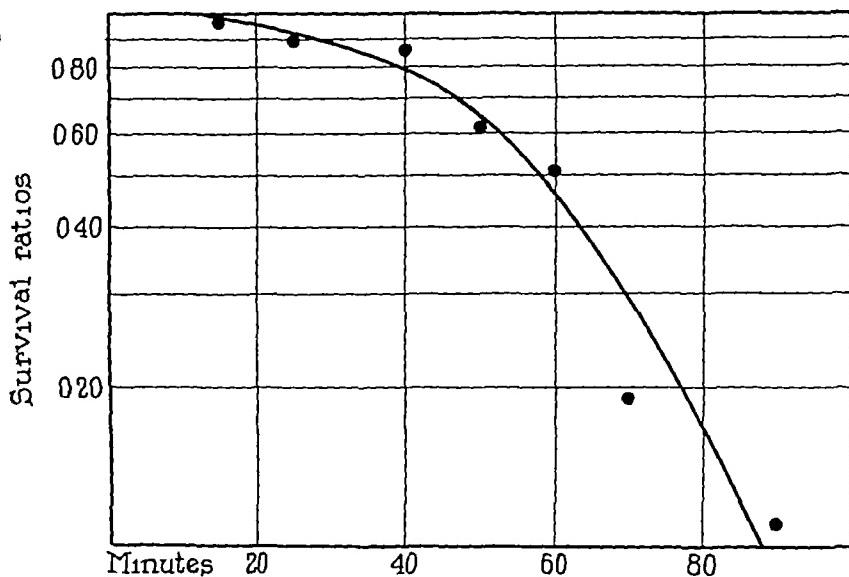


Fig. 1 The survival ratios of the spores of *Rhizopus nigricans* under the action of copper K α X-rays. Similar curves are given by the other radiations

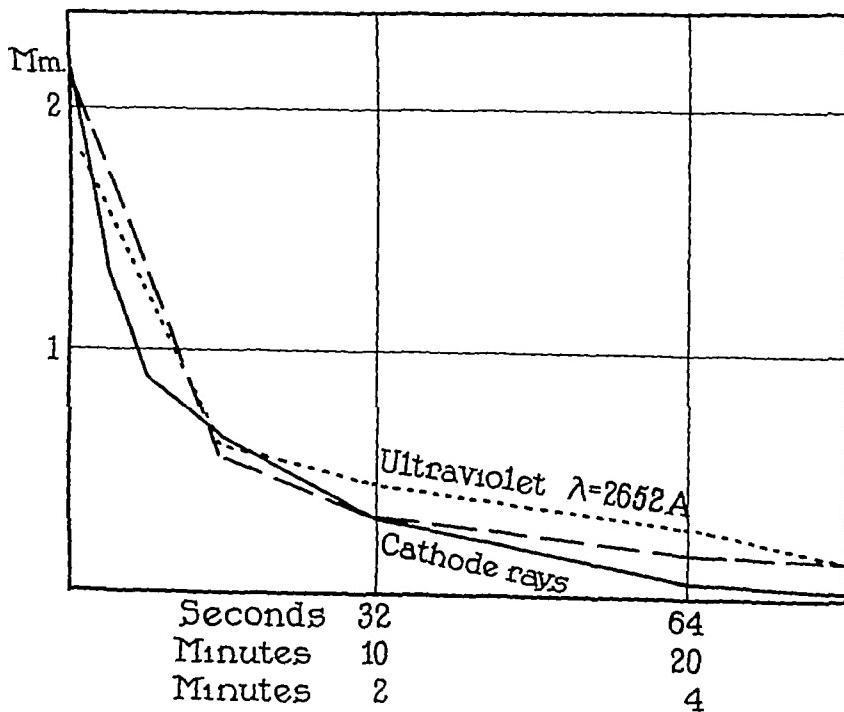


Fig. 2 A plot of the data of Table II, showing the average mycelial length of irradiated spores

stages of injury implied by these curves is to be seen in the arrested growths of Figure 2

Comparison of their killing curves shows that these spores are much more resistant than yeast cells.² At the point of 50 per cent killing, for example, it takes about twice as many cathode rays, about three times the soft X-ray energy and as much as six times the ultra-violet energy to prevent development of the fungus spores as it does to destroy yeast cells.

Many of the spores in preparations which have been subjected to cathode rays for from one-half to two minutes swell to giant size without ever producing mycelia. Sometimes they reach nearly five times their initial diameter, they are translucent and do not take on the brownish color and cytolized appearance of dead cells. Most of them stop growing within a day after irra-

diation Besides the giant spores without mycelia, others are found which, growing short mycelia before their development ceases, represent all transition stages towards normal cells X-rays and even ultra-violet light produce this effect but much less markedly The presence of swollen spores obviously makes it difficult to set up the accurate criterion of death necessary for obtaining significant survival ratios In making the counts of Table I a cell has been taken as dead if it fails to develop as much as a mycelial beak

It should also be remarked that no evidence whatsoever has been found of a stimulative effect from small doses of radiation.³

The writer is indebted to Dr Ralph W G Wyckoff, in whose laboratory the present experiments were carried out, for many suggestions and for help in the preparation of this note.

²G Nadjon and G Philippov Compt rend Soc de biol.
Feb 10 1928 XCVIII 366-368

TABLE I.—SURVIVAL RATIOS FOR SPORES OF *Rhizopus nigricans*

| For Cathode Rays | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|
| Time (seconds) | 16 | 32 | 60 | 120 | 240 | | | | |
| Ratios | 1.00 | 0.65 | 0.59 | 0.35 | 0 | | | | |
| For X-rays | | | | | | | | | |
| Time (minutes) | 10 | 15 | 25 | 40 | 50 | 60 | 70 | 90 | 100 |
| Ratios | 1.00 | 0.96 | 0.89 | 0.87 | 0.61 | 0.51 | 0.19 | 0.11 | 0.02 |
| For Ultra-violet Light, $\lambda = 2,536 \text{ \AA}$ | | | | | | | | | |
| Time (minutes) | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 50 |
| Ratios | 1.00 | 0.99 | 0.77 | 0.69 | 0.45 | 0.23 | 0.20 | 0.11 | 0.08 |
| For Ultra-violet Light, $\lambda = 2,652 \text{ \AA}$ | | | | | | | | | |
| Time (minutes) | 4 | 5 | 8 | 10 | 13 | 16 | | | |
| Ratios | 1.00 | 0.98 | 0.49 | 0.16 | 0.06 | 0 | | | |
| For Ultra-violet Light, $\lambda = 2,900 \text{ \AA}$ | | | | | | | | | |
| Time (minutes) | 10 | 15 | 20 | 25 | 30 | 35 | 40 | | |
| Ratios | 1.00 | 0.87 | 0.59 | 0.34 | 0.15 | 0.12 | 0.05 | | |
| For Ultra-violet Light, $\lambda = 3,132 \text{ \AA}$ | | | | | | | | | |
| Time (minutes) | 30 | 45 | 60 | 90 | | | | | |
| Ratios | 1.00 | 0.87 | 0.61 | 0.46 | | | | | |

TABLE II.—AVERAGE LENGTH OF *Mycelium* DEVELOPED BY AN IRRADIATED SPORE

| For Cathode Rays | | 0 | 4 | 8 | 16 | 32 | 60 | 120 | | |
|---|------|------|------|------|------|------|------|------|------|----|
| Time (seconds) | 2.21 | 1.32 | 0.89 | 0.64 | 0.31 | 0.09 | 0.02 | | | |
| For X-rays | | 0 | 5 | 10 | 15 | 20 | 30 | 40 | 50 | 60 |
| Time (minutes) | 2.17 | 0.56 | 0.32 | 0.28 | 0.19 | 0.16 | 0.14 | 0.08 | 0.05 | |
| Length (mm) | | 0 | 1 | 2 | 4 | 5 | 7.5 | | | |
| For Ultra-violet Light, $\lambda = 2,652 \text{ \AA}$ | | 0 | 1 | 2 | 4 | 5 | 7.5 | | | |

SUMMARY

Spores of the fungus *Rhizopus migrans* have been irradiated with cathode, X-, and

ultra-violet rays. Survival ratios with each type of radiation give curves which indicate that more than one hit or quantum absorp-

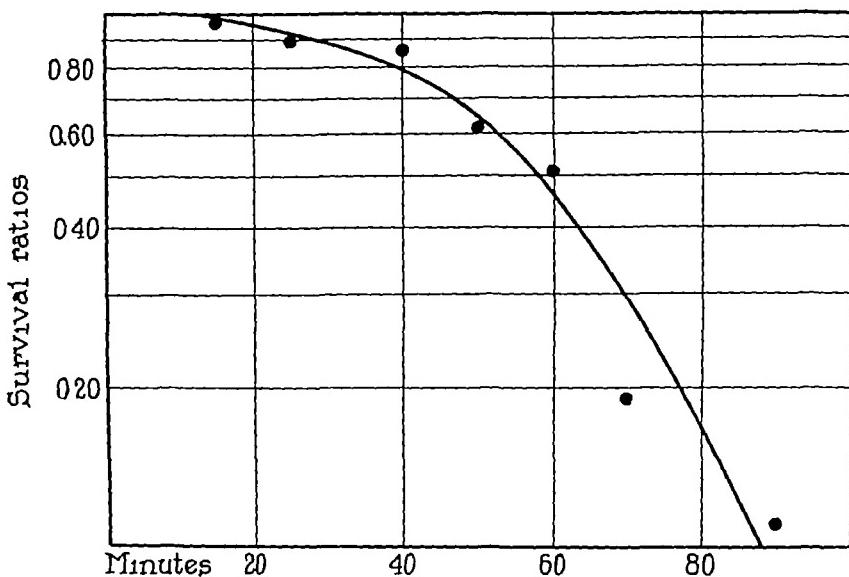


Fig. 1 The survival ratios of the spores of *Rhizopus migrans* under the action of copper K α X-rays. Similar curves are given by the other radiations

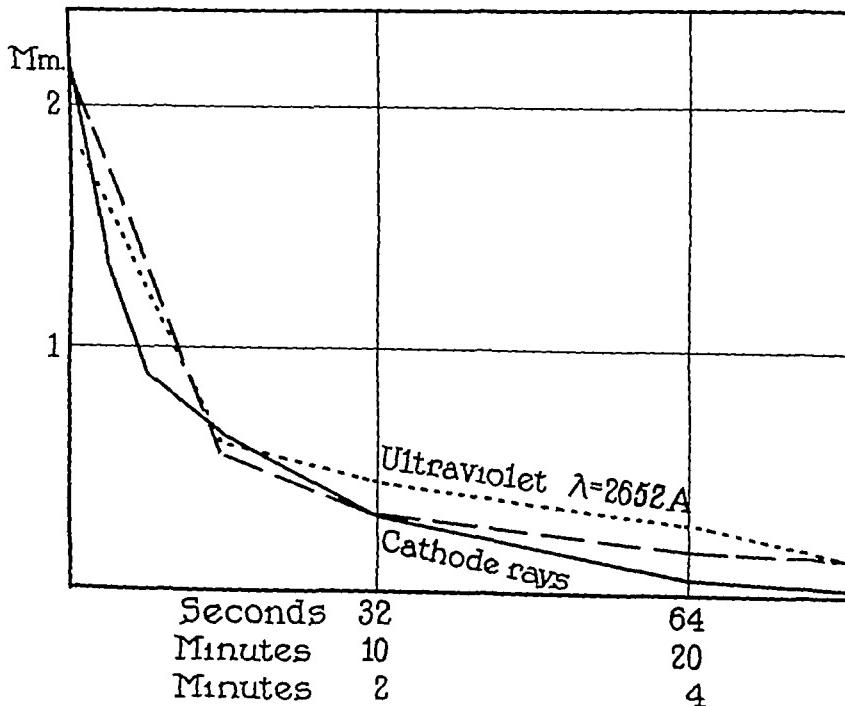


Fig. 2 A plot of the data of Table II, showing the average mycelial length of irradiated spores

tion is necessary to kill. Measurements have also been made of the decrease in growth occasioned by sub-lethal doses of each radiation.

The production of giant cells which ultimately die without undergoing further de-

velopment has been noted. They become most numerous under cathode rays and are least often seen after ultra-violet irradiation. No evidence has been found that small doses of any of these radiations are stimulative.

Electrons Speed within Dense Solids—A method used by astronomers to determine the velocity of stars has been applied in a slightly modified form to the atom to furnish the first direct evidence that electrons, negatively charged electrical portions of atoms, move about at high speeds in solid bodies.

The experiment, conducted at the California Institute of Technology by Dr. Jesse W. M. DuMond, research fellow, and Dr. Harry A. Kirkpatrick, teaching fellow in physics, was the second crucial test of activities of the electrons within the atom. The first test was reported in January, 1931.

In explaining the application of the Doppler effect to the experiment, Dr. DuMond declared that if the source of the light or sound is in motion the successive vibrating waves or ripples are crowded together on the forward side of the motion's direction, and spaced farther apart on the rearward side.

A similar phenomenon explains the fact that the sound from a train whistle approaching a stationary listener is of higher pitch than the sound of the same whistle when the train is receding from the listener. In the same way, stars approaching an observer emit spectral lines shifted toward the violet end of the spectrum, whereas receding stars emit lines shifted toward the red.

When the electron scatters X-radiation a similar effect occurs. If that part of the radiation which is scattered at a definite angle to the incoming beam is observed with a spectroscope, the spectral line which was in the original radiation is found to be shifted toward longer wave lengths and the spectral line is found to be broadened. The shift may be re-

garded analogically as a Doppler effect caused by the velocity of the electron recoiling away from the light under the impact that the light has given it. The increased breadth of the line may be regarded as a composite Doppler effect of the chaotic motion of all the electrons in the myriads of atoms scattering the X-radiation.

Dr. DuMond set the average speed of the invisible electrons which make up solid matter at 1,500 miles per second for the case of carbon. The experiment not only throws more light upon the internal activities of an atom, but proves two predictions made by Dr. DuMond in 1929. These were first, that in the spectrum of X-rays scattered by solids of low atomic number the breadth of the Compton shifted line would be proportional to the sine of one-half the scattering angle, second, that it would be proportional to the primary wave length.

The latest experiment testing the second of the above predictions was conducted with the multi-crystal spectrograph developed at the California Institute of Technology. Measurements were made of characteristic X-rays from molybdenum, silver, and tungsten scattered by carbon at an angle of 156 degrees. Spectrum photographs were made of the radiation from each element. Each exposure lasted 1,000 hours.

Dr. DuMond based his predictions two years ago upon the hypothesis that the breadth of the shifted line in the spectrum of scattered X-rays is caused by the movement of electrons in atoms. The fulfillment of the two predictions is, therefore, confirmatory evidence for the hypothesis on which they were based.—*Science Service*

DIAGNOSTIC PNEUMOTHORAX

AN AID IN THE DIAGNOSIS OF PLEURAL TUMORS

By WILLIAM B FAULKNER, JR., M.D., Department of Surgery, University of California Medical School, SAN FRANCISCO, and EDWARD C FAULKNER, M.D., Department of Thoracic Surgery, St Mary's Hospital, SAN FRANCISCO

EVEN for those who constantly see large numbers of patients with varied diseases of the chest, it is not always easy to differentiate pleural tumors from those within the lung and mediastinum. In addition it may be difficult to say with any degree of certainty which of these patients probably can be helped by surgical measures and which are beyond surgical aid. We have been faced by this problem on more than one occasion. We have seen instances in which physical examinations, plain roentgen studies, iodized oil injections, and bronchoscopic examinations either failed entirely to establish the exact diagnosis or left us uncertain as to which patients could be helped by operation, which type of operation to select, and which method of anesthesia to employ. Hence our enthusiasm in the use of a procedure which furnishes this information. Such a procedure is diagnostic pneumothorax.

In its clinical trial since its introduction by Brauer (1), in 1912, it has stood the test of usefulness (2, 3, 4, 5) and we feel that it should be adopted by a greater number of those interested in the study of intrathoracic disease. This is especially true inasmuch as diagnostic pneumothorax furnishes valuable information, is relatively safe and easy to perform, and does not aggravate the patient's condition.

The technic depends on whether or not there is an associated pleural effusion. In the absence of pleural fluid, the air usually is introduced under local anesthesia by a method similar to that employed in the treatment of pulmonary tuberculosis. A mid-axillary intercostal space is selected as the point of puncture, unless pleural adhesions are present at this point. If the tumor is

situated in the axillary region, a point of puncture on the anterior chest wall should be selected, so as to avoid the danger of perforating the tumor.

Usually from 250 to 500 cc of air will be sufficient to give the desired information, but occasionally slightly larger or smaller amounts may be necessary. We have had occasion to use as much as 1,000 and as little as 100 cc of air. In general, the total amount employed is determined by the intrapleural pressure, the vital capacity, and the subjective reaction of the patient. When the intrapleural pressures are negative (normal), the pneumothorax can be induced with safety, but the pressures must be rechecked after the introduction of every injection of from 25 to 50 cc of air. This permits discontinuance of the pneumothorax before the pressure becomes positive. In



Fig 1 Roentgenogram showing a tumor in the hilus region. From this plate one cannot say whether the tumor is in the mediastinum, lung, or parietal pleura. *T*—tumor; *unlettered arrow*—aorta.



Fig 2 Same patient as in Figure 1 Diagnostic pneumothorax roentgenogram taken at the end of inspiration. *U*-left upper lobe containing iodized oil is displaced downward by the pneumothorax. Arrows indicate the tumor (*T*) which is not attached to the lung.



Fig 3 Same patient as shown in Figure 2 Plate taken at the end of forced expiration. The unlettered arrows indicate the tumor which has moved toward the sound side. Compare with Figure 2. *U*-upper lobe containing cangioid (iodized oil), *E*-edge of displaced upper lobe.

patients in whom the initial manometer readings fail to show the normal fluctuation, or indicate a positive intrapleural pressure, no air at all should be introduced. Similarly, extreme pain, undue anxiety, dizziness, shortness of breath, or unusual subjective reactions should be taken as indications for the discontinuance of the pneumothorax regardless of the amount of air that has been introduced at the time the symptoms appear. These precautions lessen the likelihood of tearing pleural adhesions and producing pulmonary trauma, spontaneous pneumothorax, empyema, and cerebral air embolus. In the debilitated, and in those with a decidedly lowered vital capacity, much smaller amounts of air are to be employed and especial caution is to be observed during the induction of the pneumothorax.

If a pleural effusion is present which interferes with the roentgen visualization of the suspected tumor it would be both faulty and dangerous to remove all the fluid and then attempt the introduction of air into

the pleural cavity. Such a technic leads to sudden alterations in the intrapleural pressure, produces sudden and marked changes in the position of the heart and mediastinal structures, and leaves the patient liable to

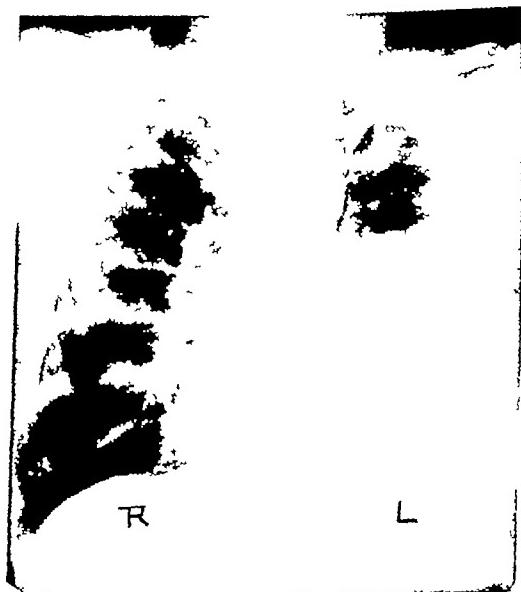


Fig 4 Roentgenogram before diagnostic pneumothorax.

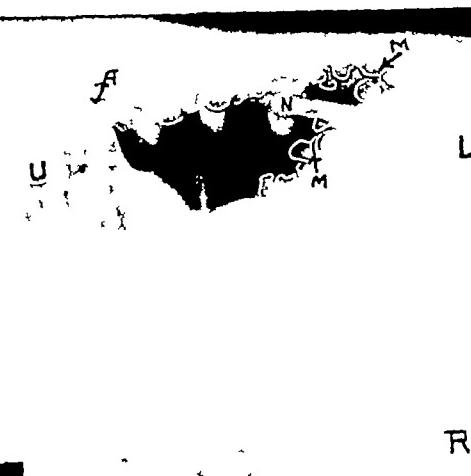


Fig 5 Diagnostic pneumothorax roentgenogram of same patient as in Figure 4 (Plate taken with patient lying on right side) *M*-Nodular masses involving the lower two-thirds of the pleura and the diaphragm, *U*-upper lobe adherent to lateral chest wall at *A*, *N*-Needle and cannula in place so that the air can be removed at the completion of the roentgen studies

severe respiratory and circulatory disturbances A thoracentesis should be performed, but, if severe disturbances are to be avoided, each syringeful of fluid should be replaced at once by an equal amount of air

After the introduction of the air, the patients are examined fluoroscopically and X-ray plates are made with the patient in various positions The aim of these various postures is to allow the air to collect at the areas that we wish to study Most often, the anteroposterior, lateral, horizontal, and Trendelenburg positions suffice, but, in exceptional cases, it is advisable to employ additional postures The initial fluoroscopic examinations not only determine the positions best for the taking of the X-ray plates, but also indicate the presence or absence of pleural adhesions, the amount of mediastinal movement, and the influence of respiration upon the position of the tumor As will be shown, these factors are important in differentiating pleural tumors from those within the lung or mediastinum

In the absence of pleural adhesions and when the patient is in the erect position, the pneumothorax displaces the lung down-



Fig 6 Specimen from the same patient as shown in Figures 4 and 5 *L*-Lung, note the nodular masses of various sizes and shapes on the diaphragm, *D*, and pleura *P*

ward, medially and away from the costal pleura The air serves as a contrast medium so that tumors of the parietal pleura stand out in bold relief Their position is unchanged following pneumothorax, or upon postural changes of the patient, inspiration or expiration On the other hand, pulmonary tumors



Fig 7 Plain roentgenogram of patient with suspected pleural tumor *T*-Trachea displaced to the

are displaced by the air. They change their position with changes in the posture of the patient, move toward the pneumothorax side on inspiration, and return toward the opposite lung on expiration. Mediastinal tumors

thoracentesis revealed a serosanguineous exudate, which was removed and replaced by air. The roentgenogram taken, following the introduction of air, indicated that the condition was more than a simple hemo-

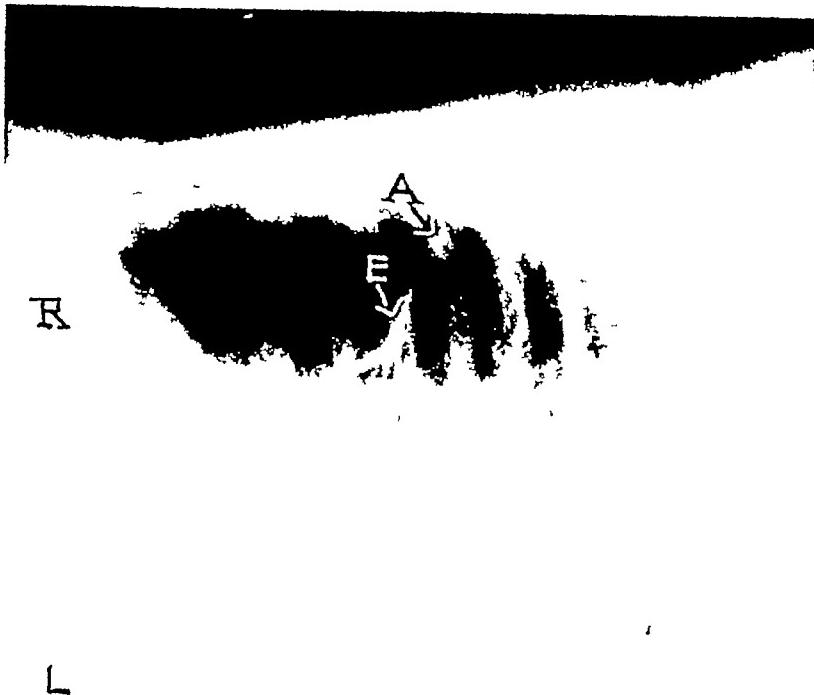


Fig. 8. Diagnostic pneumothorax roentgenogram (same patient as shown in Figure 7), horizontal position. The pleura is smooth and shows no evidence of a growth. E—lung edge, A—adhesions to lateral chest wall.

are much less often displaced downward or upward by the air, their only appreciable movement being the swing toward the pneumothorax side on inspiration and the return on expiration (Figs. 1, 2, and 3).

CASE REPORTS

The practical value of diagnostic pneumothorax was well demonstrated in two of our recent cases.

Case 1 In a male patient, aged 60 years, who complained of chest pain, dyspnea, and weakness of three months' duration, the physical findings and plain X-ray films pointed to an effusion at the left base, the

thorax, for the parietal pleura was involved by large nodular masses (Figs. 4 and 5). From these plates it was evident immediately that this was not a case for surgery and the prognosis was established as decidedly bad. X-ray treatments were employed but the patient died a few months later. A comparison of the pneumothorax roentgenograms with the pathologic specimen indicates clearly the value of pneumothorax in accurately localizing pleural tumors and in determining the cases that are suitable or unsuitable for surgery (Fig. 6).

Case 2 In another elderly patient, a pleural tumor had been suspected following the usual clinical examinations, but the diag-

nostic pneumothorax demonstrated that the pleural surface was smooth and without evidence of a growth. This was confirmed later at necropsy (Figs 7 and 8).

For each of the foregoing patients, an exploratory thoracotomy had been considered seriously, but, following the diagnostic pneumothorax, the correct diagnosis, the extent of the involvement, and the unsuitability for operation were established. Accordingly, both patients were spared unnecessary surgical procedures.

DISCUSSION

As with other diagnostic procedures, pneumothorax has its limitations, largely because of pleural adhesions which may be so generalized that no air at all can be introduced or so situated as to interfere with the displacement of the lung and mediastinum. In such cases, an exact pre-operative differential diagnosis cannot be made by this method. In many other instances, pneumothorax will be of service and will supplement the other accepted methods of investigation. By determining the site and extent of adhesions and the mobility of the mediastinum, pneumothorax guides the way in the selection of proper surgical approach and choice of anesthesia for the individual patient.

In patients who present definite indications for surgery, the air may be left in the pleural cavity so that the patient can adjust himself gradually to the changes which would otherwise occur suddenly during the opening of the thorax. If a two-stage operation is planned, with suture of the lung to the parietal pleura at the initial operation, the air should be withdrawn before the surgical procedure.

Generally speaking, there are two rules to observe. When patients have no associated pleural effusion, as much air may be withdrawn as was introduced. This is not true when there is an extensive pleural effusion.

In these cases, only enough air should be removed to permit the trachea, heart, and mediastinal structures to return to their normal positions. This can be determined rather satisfactorily by palpating the trachea and by percussing the area of cardiac dullness, but the safest and most accurate guide during air withdrawal is the manometric registration of intrapleural pressure. The pressure should not be allowed to become more negative than -6 cc of water on expiration and -12 on inspiration, because, if too much air is removed, the mediastinal structures will be drawn toward the involved side and serious and alarming symptoms may ensue.

CONCLUSIONS

1. The term "diagnostic pneumothorax" is used to designate the introduction of air into the pleural cavity for diagnostic purposes.

2. The procedure is safe, relatively easy to perform, and does not aggravate the patient's condition.

3. Diagnostic pneumothorax is of definite value in the differentiation of parietal pleural tumors from those within the lung and mediastinum.

4. It furnishes essential information in the selection of chest cases for operation, and it indicates the type of anesthesia and surgical approach that will be best fitted to the individual case.

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MEDIASTINAL PLEURISY¹

CASE REPORTS AND X-RAY DIAGNOSIS

By HENRY SNURE, M.D., LOS ANGELES, CALIFORNIA

WHILE mediastinal pleurisy is not a frequent lesion it is probably more often overlooked or incorrectly diagnosed than any other pleural condition. Unless an X-ray examination is made, it is not often diagnosed until rupture into a bronchus or other organ of the chest occurs, this latter complication being frequently a serious one. However, mediastinal pleurisy was known and diagnosed in Laënnec's clinic long before the roentgen era. Both the dry and serofibrinous types of mediastinal pleurisy are occasionally overlooked by X-ray methods but these heal practically spontaneously without permanent injury to the patient. The non-tuberculous type of purulent effusion may be fatal unless surgical intervention is begun early and drainage established. It would seem that the pure pneumococcus type of effusion is about the only form that can rupture into a bronchus and the patient survive, this rupture usually taking place within a twenty-day period.

The index of the Surgeon General's Library and the Cumulative Index of the American Medical Association list 53 papers dealing with mediastinal pleurisy, most of which are in the French and German literature. The papers of Devic and Savy, 1910 (1), and of Savy, 1910 (2), are the ones to which reference is most often made. Worthwhile papers in the American journals are those of Frick (3), and of Sagel and Rigler (4). A considerable number of the recent foreign papers deal with conditions simulating mediastinal pleurisy, such as bronchiectasis and childhood tuberculosis. Dolley (5) has recently collected 106 cases

from the literature. Because the actual number of case reports is small, three are included in this paper.

Several classifications have been suggested for mediastinal effusions, the one most commonly used describing the location of the effusion as right or left, anterior or posterior mediastinum. Combinations of the foregoing occur, and at times a further division into upper or lower has been made. Another classification divides mediastinal effusions according to the type of exudate: serofibrinous (tuberculosis), hemorrhagic (tuberculosis, trauma, tumor), and purulent (tuberculosis, tumor, trauma, pneumonia, mediastinitis). The mediastinal effusions are encapsulated mesially by the mediastinal pleura and laterally by the pulmonary visceral pleura. When extension occurs to the sinuses of the pleural cavity, it is designated as the costomediastinal type by Herrnheiser (6). Barjon (7) alludes to a so-called hilus type and describes three cases.

A good description of the clinical syndrome is given by Dieulafoy, quoted by Rose (8). Dieulafoy states "Mediastinal pleurisy starts as an acute febrile attack with pain, fever, cough, and dyspnea. The symptoms caused by pressure on the mediastinum are dyspnea, stridor, sucking in of chest wall, dysphagia, distention of the veins of the chest, fits of coughing and suffocation, hoarseness, dysphonia, and spasm of the glottis. All, or only some, of the symptoms may be present, due to whether the pressure is on the trachea, esophagus, azygos vein, the pneumogastric or recurrent laryngeal nerve." The clinical sign of dullness, usually posterior, appears about the tenth day. Voice changes should suggest a bronchoscopy examination. The pneumo-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles Dec 1-5, 1930

coccus type of effusion is ushered in by sudden onset and high temperature, if rupture into a bronchus occurs, the discharged mate-

are more circular in outline and are not apt to extend to the opposite side. Infected cysts have caused effusions. Whereas the

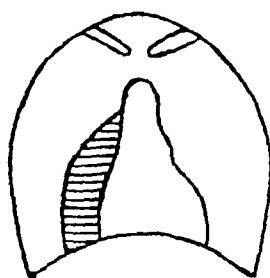


Fig 1 Right anterior mediastinal pleurisy (Devic and Savy)

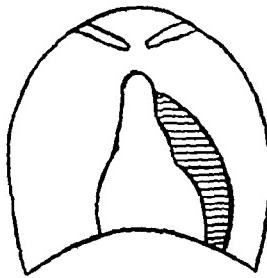


Fig 2 Left anterior mediastinal pleurisy (Devic and Savy)

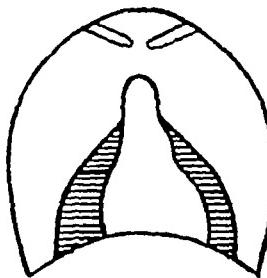


Fig 3 Right and left anterior mediastinal pleurisy (Devic and Savy)

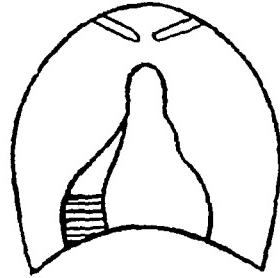


Fig 4 Right anterior, with pneumothorax (Devic and Savy)

rial is thin in consistency and does not have a foul odor.

Roentgen technic consists of a thorough fluoroscopic examination of the chest followed by films made not only in the usual positions but also in such other positions, as indicated by the fluoroscopic examination, as will best visualize the pathology under consideration. Over-exposed films are useful in doubtful cases, especially left-sided effusions (Fig 6) that might be obscured by the heart shadow. Injection of a small amount of air at the time diagnostic puncture was made proved to be of great aid in one case observed by myself. Destot (7) suggests the inflation of the stomach with air when pericardial and mediastinal effusions are to be differentiated because pericardial effusion causes bulging of the shadow into the air bubble of the stomach. The barium meal will rule out dilatation, diverticula, or ulcerating carcinoma of the esophagus.

The differential diagnosis of tumors and mediastinal pleurisy is sometimes difficult as both usually have convex borders extending into the lung area; however, tumors and enlarged glands are more likely to be in the hilus area and the effusions to be nearer the diaphragm. The effusions high in the chest may resemble cysts (Fig 8), however, cysts

shadow of pericardial effusion is of even density, in mediastinal effusion the heart can be definitely outlined within a larger shadow, and pulsation is not of much help unless it is one-sided. Ruggles (9) states the sign of greatest value is the paradoxical movement of the heart with forced respiration which occurs when mediastinitis is present. While cold abscesses are visualized as fusiform shadows including the spine, pleurisy is usually on one side, with no destruction of the vertebrae present. Assmann (10) illustrates a tuberculous type that has a concave lung border instead of the usual convex border; however, tuberculosis as a rule is diagnosed by clinical methods, and X-ray evidence of the disease is often present in other parts of the chest. Mediastinal pleurisy may become interlobular and then rupture into a bronchus, as described by Schinz (11). Rupture into a bronchus is well shown by Sante (12), who also presents diagrams showing interlobular extension. The heart shadow is not often displaced. Aneurysm and substernal thyroid have at times caused confusion. Assmann found several typical shadows of mediastinal pleurisy that at postmortem were proved to be indicative of some other lesion. On the right side a vena cava inferior simulated the tuberculous type, on the left side,

a large fat pad at the apex of the heart was confusing, again a typical posterior left-sided triangular shadow, paravertebral in

painful cough, stabbing sharp pains in the lower right chest, dyspnea, very rapid pulse, and post-influenzal asthenia

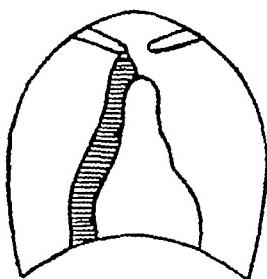


Fig 5 Right posterior, paravertebral type (*Assmann*)

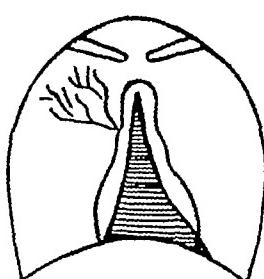


Fig 6 Left posterior, tuberculous origin (*Assmann*)

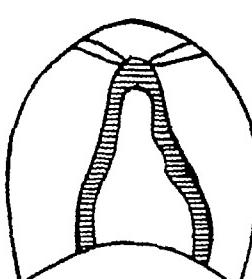


Fig 7 Early right and left posterior (*Decic and Savv*)

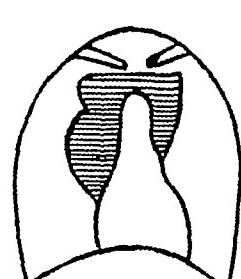


Fig 8 Right and left posterior mediastinal (*Groedel*)

position, visualized through the heart shadow, was found to be a densely infiltrated extra lobe of the lung Lenk (13) also illustrates a typical right-sided mediastinal pleurisy that later proved to be a neurofibroma of the right vagus nerve Groedel (14) reports a case of non-infectious mediastinal collection of fluid, namely, a hemorrhage into the right posterior mediastinal space following penetration of the chest by a granite splinter He also illustrates an unusual case of right upper posterior mediastinal effusion that extended to the left posterior mediastinal space in its upper portion In this latter case effusion did not extend much below the hilus area

I have compiled a chart (Figs 1-8) showing the most common types of mediastinal pleurisy, although combinations are not unusual These diagrams are copied from text-books and authors' names are appended Diagrams were made of my own cases (Figs 9-11) because direct prints from the films failed to bring out the proper contrast

CASE REPORTS

Case 1 H. E., male, age 31 years, entered the hospital on Jan 21, 1929, complaining of a persistent, non-productive,

Clinical examination revealed an advanced mitral stenosis and myocarditis Moist râles were present over both lower lobes, as was dullness on percussion on the right side of the heart anteriorly and posteriorly Except for a few days after admission, the man's temperature was continuously under 99 degrees Respiration was almost constantly at 24 The pulse was very irregular, often reaching 120

During his stay in the hospital the leukocyte count varied between 13,000 and 15,000, with 80 to 85 per cent polymorphonuclears On admission, the urine contained an occasional hyaline cast Casts and albumin increased gradually up to the time of death The blood cultures were negative

The first films (Fig 9) of the chest showed a sharply defined shadow along the right cardiac border, with a small amount of free fluid in the left costophrenic angle The right diaphragm was of normal curvature and excursion, with no free fluid in the right costophrenic angle The shadow gradually enlarged and a diagnosis of right posterior mediastinal pleurisy was made About 300 c.c. of purulent material, which gave a pure culture of *Staphylococcus aureus*, was removed from the right poste-

rior mediastinal area. The shadow had almost disappeared three days after surgical drainage, only a few stringy lines radiat-

X-ray examination on admission showed the lower half of the right chest area to be increased in density and this density changed

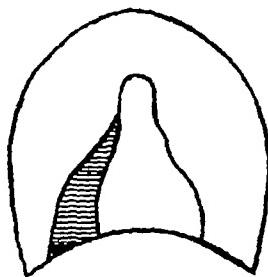


Fig. 9 Right posterior,
Case 1

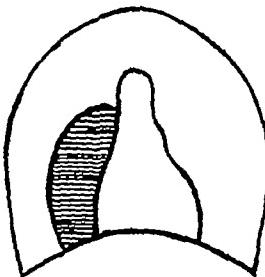


Fig. 10 Right poste-
rior, Case 2

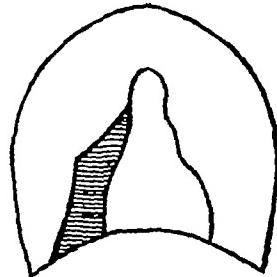


Fig. 11 Right poste-
rior, Case 3

ing from the hilus region remaining. Ten days later the films showed no further changes.

The patient died of acute dilatation of the heart three weeks after surgical drainage and seven weeks after admission to the hospital. Autopsy was refused.

Case 2 H. S., male, age 23 years, grocer, entered California Hospital on Nov. 3, 1929, complaining of pain in the right chest at the level of the eighth rib in the axillary line, also coughing of the non-productive type. The history was of sudden onset two weeks earlier. There were no physical signs on admission.

The urine contained a trace of albumin. The respiration varied between 20 and 25 throughout the course of the infection. The pulse rate was practically fixed at 95. The temperature varied from 99 to 101 degrees. On admission, the leukocyte count was 11,300, with 68 per cent polymorphonuclears; from November 15 to 19 the pulse rate increased to 100, temperature to 103 degrees, and the leukocytes gradually increased from 12,000 to 25,000, with 86 per cent polymorphonuclears. Surgical drainage was then instituted and laboratory findings soon returned to normal, but a slight discharge continued for about four weeks after operation.

with position. A clear, straw-colored fluid to the amount of 500 cc was aspirated in the axillary area. Cultures from this fluid remained sterile. X-ray examination a few days after aspiration showed no free fluid in the costophrenic angle, but a sharply defined shadow (Fig. 10) was present along the right side of the mediastinum. This shadow increased in size for one week, extending to the right posterior chest wall. Aspiration posteriorly at the level of the right transverse process of the seventh dorsal vertebra yielded 160 cc of pus containing Gram-positive cocci in chains and pairs. Surgical drainage was instituted at the site of puncture. Many small cavities separated by soft adhesions were found to be present between the mediastinal pleura and the pulmonary visceral pleura. The adhesions were broken down until one large cavity existed, but great care was taken not to involve the parietal pleural cavity. Complete recovery took place six weeks after operation.

Case 3 M. P., female, age 9 years, entered the hospital on March 7, 1929, complaining of a painful cough which began three weeks earlier, following a cold.

Examination revealed dullness on the right side of the heart posteriorly as far as the inferior angle of the scapula. Ante-

riorly it was continuous with liver dullness. No râles were present.

On admission the leukocyte count was 16,800, with 78 per cent polymorphonuclears, gradually dropping, twelve days later, to 9,000, with 75 per cent polymorphonuclears. Smears for bacilli of tuberculosis were negative. The temperature was below 100 degrees at all times. The pulse varied greatly, frequently up to the rate of 120. The respiration varied between 20 and 30.

X-ray films (Fig. 11) on admission showed a sharply defined triangular shadow with its base on the diaphragm in the right cardiophrenic angle, posterior in location. The right diaphragm had a normal curvature and excursion, with no free fluid in the costophrenic angle. Five days later, the triangular shadow was seen to have increased about 25 per cent in size. One week after this second examination no change in size was demonstrated but the patient was much improved clinically. The child was discharged one week after this X-ray examination as cured and has had no recurrence of symptoms since.

COMMENT

It will be noted that in all three cases the temperature, pulse rate, and leukocyte count were only slightly increased. All patients had a non-productive cough, with pain on the right side. The symptoms were of several weeks' duration before admission to the hospital. At first, these patients were placed in bed at home and treated as ordinary pleurisy cases, if X-ray examinations had not been made the true conditions would not have been discovered. Cases 1 and 2 were proven by operation. Case 3, when viewed in the anteroposterior plane, resembled the anterior type of effusion (Fig. 1), which is explained by Herrnheiser as due to extension to the costomediastinal sinus, quite common in posterior types of medi-

astinal effusions. Case 3 did not resemble a collapsed lower lobe as there was no compensatory emphysema in other lobes, nor did it resemble a collapsed lobe with bronchiectatic cavities, as suggested by Stoloff (15). The shadow remained of even density, increased in size for one week, and then showed a small interlobular extension. Tuberculosis was not demonstrated before or after the effusion occurred.

In all obscure chest conditions it is well to keep the possibility of mediastinal pleurisy in mind, and, for the present, at least, these cases should be reported. No doubt many cases of mediastinal pleurisy have been overlooked in the past.

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VIENNA ROENTGENOLOGIC SOCIETY

SESSION OF APRIL 14, 1931

Chairman PROFESSOR G SCHWARZ

Secretary DR. PRESSER

Professor Kienbock and Professor G Schwarz were elected Chairmen of the Vienna Roentgenologic Society Professor H H Berg, Dortmund, and Privatdozent G Herrnheiser, Prague, were elected corresponding members Professor G Schwarz took the chair and delivered an address in memory of Professor Dr Martin Haudek, deceased

Martin Haudek is gone from our midst The morning of March 9, we received the sad news that this apparently perfectly healthy man, with happy disposition, had suddenly passed away Haudek succumbed within a few minutes to an attack of angina pectoris, the harbingers of which had sounded a warning some time previously but had been unable to diminish to the slightest degree the creative force of this highly energetic man Two days before his death, Haudek delivered a long address at the headquarters of the Public Health Service concerning the equipment for his newly erected Roentgen Institute in the Wilhelminkenspital, to which he had devoted himself most completely during the previous months There were no indications that all his magnificent plans were to be brought to an abrupt end In Martin Haudek not only Vienna but international radiology has lost a representative of unusual make-up

On the occasion of the death of its unforgettable member, the Wiener Rontgengesellschaft received many expressions of sympathy that revealed most eloquently though sorrowfully the extraordinary esteem in which Haudek's personality and Haudek's scientific accomplishments were held throughout the world The communications came from the Deutsche Rontgengesellschaft, the Swedish Radiologic Society, the

Vereinigung Deutscher Rontgenologen und Radiologen in Czechoslovakia, the Roentgen Association of the Union of Socialist Soviet Republics, and the president of the International Congress of Radiology in Paris, likewise from Prof Hans Meyer, Bremen, and many other colleagues

Haudek, before taking up roentgenology, had been associated originally with the department of internal medicine After a course of thorough training in the Nothnagel Clinic and in the Weichselbaum Institut fur Pathologie, Haudek became, in 1907, acting director of the Frisch department of internal medicine in the Vienna General Hospital The inadequate nature of the status of gastric ulcer diagnosis brought him in contact with the method of roentgen examination, which at that time was just beginning to be developed, and awakened in him a special liking for our specialty, which grew stronger as time went on On May 1, 1908, Haudek became associated with the Holzknecht Institute, where he developed his pre-eminent ability Here Haudek, in collaboration with the Eiselsberg surgical clinic (Clairmont), developed his method for the demonstration of ulcerations of the stomach, here he worked out the symptom of the filling defect (*mschensymptom*), which has been taken up by all textbooks throughout the world, here he elaborated the radiologic criteria for the differentiation of carcinoma from a benign ulcer, the radiologic indications for stomach operations, and other forms of technic

During the World War, Haudek directed the roentgen institutes of several large hospitals, and also in these places carried on some valuable scientific researches on roentgenologic determination of the size of the

heart and the interpretation of heart roentgenograms, on chronic bone suppurations, and the roentgenologic diagnosis of internal diseases. In 1920, Haudek became director of the roentgen institute in the Vienna Wilhelmina Hospital. In addition to the further development of gastro-intestinal diagnosis, he devoted himself here chiefly to researches on the course of healing processes in pulmonary tuberculosis, to which medicine is indebted for new and valuable disclosures.

In the field of therapeutics, likewise, Haudek's restless mind was active, to mention only the important publications on the roentgen treatment of exophthalmic goiter, and irradiation treatment of conditions following operations on the digestive tract.

All the works of Haudek are characterized by perfect linguistic expression, keen logic, and unerring judgment as to what is important from the medical point of view. Haudek was right in not regarding roentgenology as a subordinate, merely technical adjvant procedure whose province is to furnish purely mathematical or purely formal findings, as, for example, the chemical and microscopic research method but as an all-embracing medical specialty equal in every way to other specialties. He never grew tired of emphasizing this point of view in smaller and in wider circles and in impressing it on his followers. He was an outstanding teacher and his pupils have carried his fame and the reputation of the Vienna radiologic school to the ends of the earth. Equipped by nature with a remarkable flow of language, a ready wit, and an engaging personality, Haudek was destined to score many triumphs in scientific assemblies, whether serving as chairman, as essayist, or as leader of the discussion. His inherent capacity for organization, for establishing useful connections, for composing differences with wisdom, firmness, and moderation, made him everywhere, within a short time, a leader in both word and

action. Since 1913, Haudek had been a permanent member of the executive committee of the Deutsche Rontgengesellschaft, and at the assembly in 1926 served as its chairman. We who have been intimately associated with Haudek will never forget the energy and judgment he displayed in preparing for the congress of Vienna in 1929. The giant task, which necessitated countless sessions with the representatives of all manner of boards and corporations and with individual interests, was solved by Haudek with pre-eminent success. Beloved by reason of his affability and his kindness and esteemed by all classes, he knew how to use his unusual popularity, just when it was needed, in the service of our specialty. He whose early passing fills us with deep sorrow was one of those figures for which there is no substitute, and whose merits and outstanding qualities are handed down to posterity, not merely for the exaltation of the deceased but also for emulation by his followers. Honor be to his memory! [The members of the assembly rose from their seats.]

HALDER'S SCIENTIFIC WORK DR. FLEISCHNER

The task assigned to me, to speak on the scientific work of my teacher, has been made more difficult by an unfortunate event that has occurred at the last moment. Professor Holzknecht,¹ who was to have spoken on the discovery of the significance of the filling defect, has been taken ill, and there is no one who can present the subject as well as he. My paper will have to be a combination of narrative and readings, and it will consequently lack the spontaneity that Professor Holzknecht, as an eye-witness and participant, might have injected into it.

It was the important period of the first development of the application of roentgenologic methods to the diagnosis of gastrointestinal disorders. Many valuable facts

¹Professor Holzknecht did not recover.

had been learned since the use of the Rieder bismuth paste. Except for a few isolated, far-from-frank observations, peptic ulcer defied roentgenologic diagnosis. It was the discovery of diverticulum-like shadow spots in the silhouette of the stomach that Haudek (at first purposely avoiding any anatomic inferences) designated the "niche" (later known in English as the "filling defect"). A wonderfully exact roentgen analysis and description of findings (considering the technical aids that were then available), together with a few operative results, led him, within a very short time, to narrow down the diagnostic significance of the filling defect, to clarify it by connecting it with a number of signs or symptoms, and to announce it as the roentgenologic expression of the penetrative callous gastric ulcer. It was a period of feverish activity. Haudek was present at the operation on every patient that he had examined. Supplementary reports followed in quick succession. At the roentgenologic congress, held in April, 1910, he reported at first on only two cases, but when the Naturforscherversammlung was held in September, the number had increased to 17, and, two months later, there were 25 cases with 14 necropsy findings. In 1911, there appeared as the result of the collaboration with Clairmont, of the Eiselsberg Clinic, the monograph on the importance, for surgery, of roentgenologic diagnosis of stomach conditions, together with the publication of 35 clinicorontgenologic case histories. It was a great disappointment for Haudek that a supplementary volume on the progress of gastro-intestinal diagnosis, which he had planned in collaboration with Holzknecht and which was almost ready for the printer, could not, for financial reasons, be published.

Haudek did not overlook the difference between the roentgen and the morphologic findings of ulcer. Little was known at that time about the anatomy of the living

stomach, and the anatomy of the cadaveric stomach was a poor correlate to the roentgenograms. Hence he explained the diverticulum-like constriction of the filling defect on the part of the stomach as a circular spasm of the muscularis mucosæ. Through recent researches (Forssell) we have learned that a swelling of the mucosa surrounding the ulcer plays the chief part in this constriction. His further research had to do with the elaboration of the morphologic ulcer diagnosis and the differential diagnosis of ulcer and cancer. Even at that time we find Haudek's differentiation, which has now become famous. The ulcer is a heavier shadow and the cancer is a lighter shadow. Although deeply interested in the elaboration of the technic of the diagnosis of gastric functioning (Haudek had substituted the testing of the 6-hour remnant in place of the examination of a 24-hour remnant, and had introduced also the expeditious double meal procedure), yet, in his mental make-up, and, in part, doubtless also influenced by the constantly confirmed diagnostic significance of his morphologic ulcer symptom, he was not inclined to overestimate the value of functional manifestations. I go back in thought to the time when, inspired by the endeavor to learn more about the pylorus and the duodenum, one differentiated and classified, for want of reliable morphologic signs, the velocity and rhythm of gastric evacuation in a most delicate manner, and (from the standpoint of our present-day knowledge) drew venturesome diagnostic conclusions therefrom. Haudek endeavored at an early period to make the filling defect and the deformations of the bulbus the basis of his diagnoses.

We will not follow further the individual phases of his work. The World War found him engaged, in part, with other problems. Studies on the estimation of the degree of disability of persons affected with heart injuries, the results of bone injuries,

and, finally, the roentgenologic diagnosis of internal diseases, written for the practitioner, and appearing in Holzknecht's "Roentgenology," were the products of this period.

In the post-war period, after his transfer to the Wilhelmenspital, his collaboration with W. Neumann and Sorgo led him to make comprehensive studies on pulmonary tuberculosis. The fruits of this labor, as published in several articles, were, above all, the calling attention to the possible retrogression of tuberculous infiltrates of the lungs and to the retrogressive and healing capacity of extensive cavity processes, without surgical intervention. Haudek was one of the first roentgenologists to call attention to the necessity of differentiating the lung apex processes. On the basis of observations in large series of cases he brought out the comparative insignificance of certain forms of tuberculosis of the apex. Passing over the large number of further articles dealing with the various fields of roentgen diagnosis and roentgen therapy, we will complete the circle by giving a more detailed account of his last researches in the field of stomach diagnosis. He began by laying the foundations and establishing the synthesis, further development and sifting characterized the closing arguments. With justified criticism, Haudek attacked the assertion that diagnostic errors of various practitioners were due to the unreliability of his filling defect symptom. Endeavoring to uphold the filling defect as a pathognomonic sign of peptic ulcer, he devoted himself indefatigably to the more delicate roentgen analysis of tumors that had broken down into ulcers. In his last extensive research on the changes in the pyloric gastric region, we find as a valuable diagnostic contribution the cancer stage or the subcardiac stage, and an exact morphology of the crateriform cancer-ulcer. From a large series of cases reported in detail, we learn here that the cancer crater forms what is usually an un-

evenly delimited shadow area within a filling defect, or, as Haudek called it, in precise terms, "a plus in a minus shadow." Whereas peristalsis usually passes unhindered over an ulcer, here the surrounding wall shows no peristaltic movements and forms by steps a contrast with the healthy stomach wall. The prepyloric filling defect, though not often observable, is a sharply demarcated shadow projection in the middle of a scutiform, smoothly contoured part of the stomach wall with a bay-like indentation. The fact that the canalis comes to a point is discussed in detail and its significance for the differential diagnosis is brought out. The difficulty and the frequent impossibility of distinguishing benign wall changes of the canalis from cancerous changes is emphasized. Especially this last great research, rich in carefully studied material extending over a long period of years, sifts, free from any preconceived intention of following any particular schema, the facts, and leads us, on the one hand, to unsuspected refinements of diagnosis, and shows us, on the other hand, the limits of our knowledge and insight. In this particular research we see Haudek, at the height of his activity, drawing from his incomparable experience, and whereas many older discoveries have long since become common property, this research permits us to recognize with no little chagrin how much Haudek might have taught all of us, if he had lived.

The chronologic study of Haudek's roentgenologic researches does not merely teach us many individual facts. We see from them—and I have observed it even more than others, owing to my collaboration with him for nearly ten years—that what gave the central direction to his researches was always primarily the clinical questioning. Haudek's principal endeavors began at the point where the clinician demanded a clarification of uncertain distinctions with reference to the treatment to be followed. From

the first to the last researches he always kept in mind the question of therapeutic indications, and he plainly limits and at the same time emphasizes the part that roentgen procedures must play. He always endeavored to test every technical measure to discover whether or not the required expenditure of time and means was justified by the anticipated success. He always sought to make his research technic as expeditious as possible and as little disturbing to the patient as was feasible. He regarded that as an essential requirement for the widest possible application of roentgen diagnosis in practical medicine.

Haudek's scientific work is not, however exhausted in the publications that lie before us in completed form. In numerous addresses delivered at congresses and assemblies, and in many discussions he expressed thoughts and gave suggestions that he did not live to follow up and to develop. Not only to his close associates but also to countless physicians who came from far and near to see the master at his work he always gave without stint out of his rich experience. He was a teacher of the old peripatetic type. One could plainly see him become animated by every kind of scientific discussion even when dealing with the youngest members of the specialty. He was a good listener when others made their presentations and on the other hand he was able to interest others in his own ideas. Taking it all in all, Haudek's work is a sheet-anchor of medical roentgenology and will remain a landmark in the history of medicine.

GRAWITZ TUMOR AFRIDIL ROENTGENOGRAMS

This demonstration concerns a patient aged 62 who, suffering from complete retention of urine and severe hematuria sought aid at the urologic ambulance of Prof. Paschkis and, after a thorough urologic examination was referred to the

Roentgen Institute. The speaker presented the intravenous pyelogram taken after injection of abrodil in which normal excretory conditions of the contrast medium in the region of the left kidney are recognizable while in the right field a filling defect is visible in the lower half of the renal pelvis. As the shadow of the right kidney is not plainly visible, a tumor is suspected and that finding is strengthened by means of retrograde pyelography which reveals likewise a filling defect in the right renal pelvis. Right nephrectomy was then performed by Prof. Paschkis. Result: a tumor of the right kidney of the Grawitz type.

CALCULUS OF THE RENAL PELVIS

A patient aged 42 after an attack of colic sought aid in the urologic "ambulance." Prof. Paschkis sent him to our Roentgen Institute. The ordinary roentgenogram reveals a finger-breadth to the left of the median line at the level of the lower sacral vertebrae a rough shadowy lobulated mass (Suspicion of calculus). As the position was atypical for a ureter stone (too far toward the median line) several roentgenograms with a sound were made, which the speaker presented. Finally retrograde pyelography was done which revealed a dys-topia of the left kidney, with a stone in the left renal pelvis (Left-sided pelvic kidney with stone.) The demonstrated roentgenograms taken by means of intravenous pyelography after injection of abrodil confirm this supposition.

PILATERAL PELVIC KIDNEY WITH STONE

The patient was a small frail man who at the time noted only vague symptoms in the lower right abdominal quadrant associated with bacterial pyuria. In the demonstrated plain roentgenogram a large coral stone in the region of the right sacro-iliac

and, finally, the roentgenologic diagnosis of internal diseases, written for the practitioner, and appearing in Holzknecht's "Roentgenology," were the products of this period.

In the post-war period, after his transfer to the Wilhelmenspital, his collaboration with W Neumann and Sorgo led him to make comprehensive studies on pulmonary tuberculosis. The fruits of this labor, as published in several articles, were, above all, the calling attention to the possible retrogression of tuberculous infiltrates of the lungs and to the retrogressive and healing capacity of extensive cavity processes, without surgical intervention. Haudek was one of the first roentgenologists to call attention to the necessity of differentiating the lung apex processes. On the basis of observations in large series of cases, he brought out the comparative insignificance of certain forms of tuberculosis of the apex. Passing over the large number of further articles dealing with the various fields of roentgen diagnosis and roentgen therapy, we will complete the circle by giving a more detailed account of his last researches in the field of stomach diagnosis. He began by laying the foundations and establishing the synthesis, further development and sifting characterized the closing arguments. With justified criticism, Haudek attacked the assertion that diagnostic errors of various practitioners were due to the unreliability of his filling defect symptom. Endeavoring to uphold the filling defect as a pathognomonic sign of peptic ulcer, he devoted himself indefatigably to the more delicate roentgen analysis of tumors that had broken down into ulcers. In his last extensive research on the changes in the pyloric gastric region, we find as a valuable diagnostic contribution the cancer stage or the subcardiac stage, and an exact morphology of the crateriform cancer-ulcer. From a large series of cases reported in detail, we learn here that the cancer crater forms what is usually an un-

evenly delimited shadow area within a filling defect, or, as Haudek called it, in precise terms, "a plus in a minus shadow." Whereas peristalsis usually passes unhindered over an ulcer, here the surrounding wall shows no peristaltic movements and forms by steps a contrast with the healthy stomach wall. The prepyloric filling defect, though not often observable, is a sharply demarcated shadow projection in the middle of a scutiform, smoothly contoured part of the stomach wall with a bay-like indentation. The fact that the canalis comes to a point is discussed in detail and its significance for the differential diagnosis is brought out. The difficulty and the frequent impossibility of distinguishing benign wall changes of the canalis from cancerous changes is emphasized. Especially this last great research, rich in carefully studied material extending over a long period of years, sifts, free from any preconceived intention of following any particular schema, the facts, and leads us, on the one hand, to unsuspected refinements of diagnosis, and shows us, on the other hand, the limits of our knowledge and insight. In this particular research we see Haudek, at the height of his activity, drawing from his incomparable experience, and whereas many older discoveries have long since become common property this research permits us to recognize with no little chagrin how much Haudek might have taught all of us, if he had lived.

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The patient was a small, frail man who, at the time, noted only vague symptoms in the lower right abdominal quadrant, associated with bacterial pyuria. In the demonstrated plain roentgenogram, a large coral stone in the region of the right sacro-iliac

synchondrosis was to be seen. The application of the sound to the ureters and the use of retrograde pyelography revealed finally a bilateral dystopia of the kidneys (pelvic kidneys), with a large coral stone at the right. Whether an amyloid kidney in the small pelvis is present or whether only a bilateral dystopia of the kidneys exists, cannot be decided from the roentgenograms. Intravenous pyelography, although carried out most carefully, failed in this case.

POLYPS OF MIDDLE EAR

L. Forschner and F. Windholz report on histologic changes in irradiated polyps of the middle ear. Among these, there were two granulation tumors that had disappeared spontaneously following roentgen irradiation, furthermore, a larger blocking antrum polyp, which extended far into the auditory meatus and which offered an opportunity, before and after the irradiation, to make several excisions of tissue, in order to compare the X-ray changes in the tissues with the unirradiated tissue. Finally, a nodule-like elevation in an acute, likewise irradiated middle ear suppuration was examined. First the histologic picture of the unirradiated piece of the blocking middle-ear polyp was demonstrated. After the application of relatively few irradiations a change in the cell content and in the cellular composition of the polyps could be noted. The number of polymorphonuclear leukocytes, lymphocytes, and plasma cells decreased materially, and an increase of the connective tissue cells and of the intercellular substance could be observed. The cell changes, the karyopyknosis, the karyolysis, and the complete degeneration of the leukocytes was demonstrated with a number of photographs. The proliferation of the connective tissue originated in the vicinity of the blood vessels. The latter had undergone varying degrees of modification. The

endothelium was swollen, while the stainability of the nuclei had decreased. The protoplasm presented vacuoles and showed degeneration, and the lumen of the vessels was frequently narrowed and gave evidence of degeneration. Also, in the capillary vessels were several layers of large, swollen cells whose nuclei and cell protoplasm gave plain evidence of the previously described conditions, in place of the simple layers of endothelium.

The speakers emphasized also that the spontaneous retrogressive changes of the middle-ear polyps showed a similarity with the demonstrated findings, of which fact they were able to convince themselves by comparison with the unirradiated polyps.

Wittmaak thought he saw a causal connection between the spontaneous healing process in the ear polyps and the degenerative processes in the blood vessels. In the same sense, it appeared not impossible that the reparative process produced by roentgen rays, aside from the direct destruction of the inflammatory cells, also the changes in the blood vessels produced by the irradiation, play a part. It is worthy of note that the appearance and the extension of the changes run by no means parallel with the irradiation dosage and duration, for occasionally after relatively small doses a marked histologic reaction is observed, which possibly, with the exception of the vascular changes, scarcely increases following prolonged irradiation. This circumstance is to be considered also in marking out the plan of irradiation. In the experience of the speakers, it appears indicated, after a few weak irradiations, to await the effect and only after an interval of from four to eight weeks to renew the irradiation as it has been shown that the therapeutic effect, if it does not appear immediately after the first irradiations, is not perceptibly increased by irradiations continued over a longer period.

EDITORIAL

LEON J MENVILLE, M D
BUNDY ALLEN, M D

Editor
Associate Editor

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IS ROENTGENOLOGY, AS A SPECIALTY, DESTINED TO SURVIVE?

Will the interests of scientific medicine be best served, in the long run, by the survival or extinction of roentgenology as a specialty? Does competent diagnosis by means of X-rays demand sufficient special training and study to justify its practice as a medical specialty? Or should it, like inspection, palpation, percussion, and other methods of physical examination, be employed simply as a part of the routine of the surgeon, the internist, the urologist, the general practitioner? These questions are not merely of academic interest to students of medical trends but are of immediate vital interest to some hundreds of roentgenologists and to some scores of young men now in training for the practice of this seriously menaced specialty.

The existence of specialties in medicine is predicated on the assumption that the theory and practice of modern medicine have grown beyond the grasp of any one man that no one can any longer be truly a "physician and surgeon" and in addition a urologist, otolaryngologist, etc. Legally, anyone possessed of a degree of Doctor of Medicine and a license to practise in his State may assume and claim special aptitude for the practice of any medical specialty, with none to say him nay. Practically, in urban communities, the amount of harm to be done by the occasional surgeon, the self-trained urologist, the incompetent otolaryngologist, is limited, since the body of medical opinion is against him. He is not encouraged to work in the best hospitals, cases are not referred to him by the qualified and ethical men who mold medical opinion. He must depend for his practice on a personal appeal to a limited circle among the laity. The tendency of the qualified specialist in any line is naturally to resent unwarranted assumptions of special qualifications which do not exist. By this mechanism the position of the well trained man, in most lines, is protected even though existing laws regarding medical licensure take no account of medical progress of the last thirty or forty years.

The position of the roentgenologist is, for a variety of reasons, quite different. The public has been trained, largely through lack of vision on the part of early X-ray workers, to marvel at the physical equipment of the roentgenologist instead of his mental equipment, to see the machine, not the man, to focus its interest on the work of technicians, rather than the work of the man in front of the viewing box. Thus, to most laymen, and unfortunately to too many med-

synchondrosis was to be seen. The application of the sound to the ureters and the use of retrograde pyelography revealed finally a bilateral dystopia of the kidneys (pelvic kidneys), with a large coral stone at the right. Whether an amyloid kidney in the small pelvis is present or whether only a bilateral dystopia of the kidneys exists, cannot be decided from the roentgenograms. Intravenous pyelography, although carried out most carefully, failed in this case.

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ical men, an X-ray examination speaks completely and finally for itself without regard to whether or not it is competently interpreted. For this reason there exists almost no public demand for the services of a physician especially trained in X-ray diagnosis, providing any other person, trained or untrained, professes intelligence and ability to take over his function. The cases of the ethical roentgenologist are almost entirely referred by other physicians. He makes no initial or independent contact with his patients. Often in hospital, and sometimes in office practice, he does not even see them, hence he has no opportunity to build up an independent clientele among the laity. Indeed, he has had no desire to do so, being well satisfied to gain the support and confidence of his medical colleagues. His position, frequently a difficult one through the necessity of maintaining friendly and equitable relations with a large group of medical men whose personal interests often conflict violently, is best fortified by his willingness to remain somewhat in the background, making no effort to project his personality upon the patient's attention.

With the advent of the Coolidge tube, the simple, compact, and reliable X-ray transformer, and dependable photographic materials, many of the technical difficulties which hindered the making of satisfactory X-ray films were removed. It became possible for a reasonably intelligent person to learn in a few months to make technically excellent roentgenograms. With the expansion, brought about by war orders, in the factories of makers of X-ray equipment, it became incumbent on their sales forces to find buyers for hundreds of new X-ray outfits. With the growth in the scope of X-ray diagnosis, conditioned by the willingness, indeed the almost frantic insistence, of the public to have X-ray examinations made for any ailment whatever, there was created a great potential market to absorb the over-production of X-ray equipment. Human greed,

never a factor to be overlooked but perhaps particularly rampant during the inflation period, was the motif of the sales argument which placed thousands of X-ray machines in the offices of medical men no more versed in roentgenology than in astrology and with no more intention of making a serious study of the one than the other. Let me hasten to add that desire for financial gain was not the only argument, and probably not often the chief argument, by which the surgeon or the internist convinced himself that he ought to take over the work of his roentgenologist. There were other, and in some respects excellent, arguments for this course of action. These will be considered later.

The chief weakness in the roentgenologist's position as a specialist lies in the almost universal application of his specialty. A tremendous proportion of patients seeking relief from illness require an X-ray examination at one time or another. The internist sends a few of his patients to the otolaryngologist, a few to the urologist, a few to the surgeon, but almost all of them require an X-ray examination. He would not think of doing his own appendectomies, or tonsillectomies, or cystoscopies, he has no special training along those lines—to attempt those procedures would be to lose caste. Men who perform them competently send him patients. But how convenient it is to have the necessary X-ray studies made in his own office! And the result of an incompetent X-ray examination is not immediately apparent, not often promptly fatal. The surgeon's problem is similar, the answer frequently the same.

The so-called commercial X-ray laboratory, conducted by technicians with perhaps a medical man nominally, but not actually, in charge, menaces the roentgenologist's position from another angle but to much the same effect. It provides the physician, who does not recognize the desirability of expert medical interpretation of X-ray findings, with a cheap and inexpert X-ray service.

without the necessity of investment in equipment. The result, so far as the patient is concerned, is apt to be much the same as though the physician or surgeon referring him to the commercial laboratory had his own X-ray equipment, except that the service may cost him less.

In hospital practice, the theoretic position of the roentgenologist as a specialist is for the most part unassailed. He occupies, however, in the modern hospital set-up, a unique and unenviable position. His relations with other members of the staff are largely of his own making and likely to be most agreeable, though in smaller institutions there may be a slight tendency to rate him somewhere between a laboratory technician and a doctor. But his remuneration for his professional services usually derives from a fee-splitting arrangement with the business management of the institution. The fees are often fixed by the business management at a figure to conform with local practice. If, through his efforts, the roentgenologist succeeds in building up a larger volume of work in his department than the hospital board thought possible when the original arrangement was made, he is very likely to find the business management casting covetous glances at his monthly earnings. If he does not accept a reduction in his percentage, he is apt to be replaced by a cheaper man. Thus the hospital roentgenologist is oftentimes sampling the joys of socialized medicine some years in advance of his confrères.

Clearly any field of endeavor which does not promise adequate reward for effort and considerable scope for ambition will not long continue to attract men of ability. It should not be understood that the tendencies described have become fully effective, nor that they are equally active throughout the country. There are still many roentgenologists in clinics, in hospitals, and in private practice who, so far as their personal experience extends, would hardly realize that

roentgenology as a specialty has suffered serious inroads in these past few years. To the majority, however, it is an all too evident fact.

Presumably it is the aim and intention of the medical profession, as a whole, to give the public the most effective possible medical service in the most efficient, feasible manner, efficiency being defined as the ratio of results achieved to effort expended. Does, or can, the roentgenologist earn a permanent place in the ideal scheme of effective medical service which the public expects, and particularly, at this time, demands, in return for its huge outlay? We hear much of the high cost of medical care. Will the survival or the extinction of roentgenology as a specialty best serve to decrease this cost?

There is evident very little tendency on the part of the profession to deny the roentgenologist's superior skill in the interpretation of roentgen findings. This is proven by the regularity with which physicians demand for themselves, their families, and medical men under their professional care the opinion of the full-time, rather than the occasional, roentgenologist. It is shown by the frequency with which the roentgenologist is called on for interpretations, usually as a favor, of films made by the amateur X-ray worker, if the surgeon or internist who operates his own X-ray apparatus may be fairly so called. It is evidenced by the uniformity with which highly trained and usually very well remunerated roentgenologists are employed by great clinics, teaching hospitals, and like institutions. It is, then, not in the interest of greater diagnostic accuracy that private X-ray plants and commercial laboratories are so common.

Considerable stress is often placed on the greater convenience to the physician and the patient of having the X-ray examination conducted in the physician's own office, of the saving in time of having films immediately available for interpretation. This argument has some force. Offsetting it is

the fact that the amateur roentgenologist tends to make his X-ray interpretations conform to his clinical impressions At the time when he needs an independent and unbiased point of view, he inclines to interpret what he sees in the light of physical findings, history, and laboratory reports Only the most strikingly contradictory appearances on the films or screen can lead him away from his already made tentative diagnosis When the patient should have, and is usually paying for, a consultation, he often gets only the empty routine of a roentgenologic investigation Everyone who has checked closely the roentgen interpretations even of men very able in other lines, who elect to do their own X-ray work, knows that this happens often, causing enough missed diagnoses to controvert the argument of convenience—if the patient's welfare or even the physician's prestige is to be the basis for decision of the usefulness of the roentgenologist Furthermore, in this connection as elsewhere, time can often be saved, but at too great a cost Except in emergency, a less hurried and more considered interpretation of dry films makes for greater accuracy

Turning to the economic aspect, expensive equipment occupying costly floor space can add to efficiency only if it is frequently and profitably used There are at present in this country, installed in doctors' offices, enough modern X-ray equipment to do the X-ray diagnosis work of the entire world and one or two other planets besides Most of it stands idle a great part of the time Obviously the patient pays depreciation and upkeep on this huge collection of machinery Two-thirds of it is not paying its way even in the narrow sense of bringing its owners sufficient cash return to meet overhead and operating expenses Such a state of affairs must be abhorrent to the economic-minded examiner into the cost of medical care Physicians being notoriously poor business

men, many owners of such semi-idle equipment do not realize what a financial burden it is Others, with more acute financial sense, realizing it, are tempted to find more work for it to do, even if the indications for extensive or repeated X-ray examinations do not clearly exist Thus grows the cost of medical care

Certainly there can be no just criticism of the physician who, owing to his location, finds it necessary to have his own X-ray equipment or deny his patients, and himself, the protection of X-ray diagnostic service In this, as in other fields, he does the best he can, often shaming the specialist, and he is only to be complimented

Objection has sometimes been made to the high cost of X-ray examination This cost has been sometimes offered as an excuse for installing private X-ray equipment—the physician wishes to protect his patients from the exorbitant charges of roentgenologists The general run of basic X-ray fees has not changed since 1914, when the dollar had somewhat more buying power in other lines than it now has The roentgenologist operates under a tremendous overhead expense, and, having no other source of professional income to divert, consciously or unconsciously, to meet a deficit in his X-ray operations, he usually knows about what it costs him to make an X-ray examination He has no abnormal desire to get rich, which is as well for his peace of mind It is estimated that the overhead expense of the average, fairly busy X-ray laboratory amounts to 50 per cent of the collections, a proportion considerably higher than obtains in any other medical specialty Net incomes of roentgenologists, as far as can be learned, average less—not more—than those of other medical men in special practice It is clear to anyone who studies the figures of overhead and income pertaining to X-ray laboratories that any general reduction in X-ray diagnostic charges can come only through

fuller utilization of existing facilities and through greater volume of work in efficiently conducted roentgen laboratories—not through additional duplication of equipment and scattering of effort

The roentgenologist who wishes personally to survive, who desires to protect his specialty from what he considers unfair attack, apparently has no recourse save the education of the profession or the public in the need for his specialized effort. He is reluctant to appeal to the public, impersonally and with largely altruistic motives, after the manner of, for instance, the cancer education campaign, though it could be done, as many think, justifiably, ethically, and successfully. Can he succeed in educating his professional colleagues?

Note—Throughout the above discussion the terms "roentgenology," "roentgenologist," "roentgen laboratory," etc., have been employed as applying to the use of X-rays in diagnosis only. There is relatively little tendency on the part of the profession at large to encroach on the treatment field, a fact which has proven the salvation of many radiologists.

CHARLES D. ENFIELD, M.D.
Louisville, Ky.

RADIOLOGIC EDUCATION

RADIOLOGY presents this, its Educational Number, containing different articles of educational interest, so that its readers may have a true conception of the status of radiologic education in the United States and Canada.

It was thought for a long time that, because radiology is a highly specialized branch of medicine, it should be taught only in the graduate schools of medicine, for this reason many of the undergraduate schools held it to be of minor consequence. The science of radiology has advanced so rapidly

since then that at present it is considered essential in the undergraduate curricula of medical schools.

An examination of the report contained in a paper entitled "A Statistical Study of Radiologic Teaching in the Medical Schools of the United States and Canada," appearing in this issue of RADIOLOGY, shows much interesting and valuable information. Each of the 81 recognized schools of the United States and Canada gives a substantial number of hours to the teaching of radiology. It is interesting to note that six of our schools offer 20 hours of radiology in the freshman year and 10 schools offer 95 hours in the sophomore year. Canada does not give radiologic instruction in the freshman year, but one school offers 30 hours in the sophomore year. One of the main reasons why radiology is being given this consideration in freshman-sophomore medicine is because of its practical application in some of the subjects, particularly anatomy and physiology, taught in these years.

For years the only means of teaching anatomy was principally by demonstrations on cadavers, but to-day, with the use of the roentgen ray, anatomists are teaching the structure of the living. Oscar V. Batson, M.D., a well known anatomist, once said, "I have taught first-year medical students and first-year dental students, and I am now teaching graduate doctors, preparing for special fields of practice. I have excellent opportunity to observe a bird's-eye view of the results of medical school teaching in anatomy and I am more convinced than ever that the teaching of anatomy must be in fact the teaching of anatomy of the living."

Likewise, the roentgen ray has a distinct application for teaching purposes in the other fundamental branches of medicine—physiology, pathology, etc. It can be appreciated, therefore, that radiologic teaching is not restricted to the clinical, or the last two years of medicine, but a fair amount of time

is also given to the students in the first two years

It is most gratifying to observe that a large number of medical schools have separate Departments of Radiology, also that many of the radiologists connected with these departments hold professorial positions, and but a very small percentage occupy minor positions, such as assistants and lecturers in radiology. Then, again, we find that a total of 1,797 hours is assigned to the teaching of radiology in our medical schools and 293 hours in the Canadian schools, a grand total of 2,090 hours for both Canada and the United States.

This large number of hours devoted to the teaching of radiology is but another evidence of the importance in which radiology is held. Its recognition on a parity with other highly specialized branches of medicine was to be expected but that its recognition should come from such authoritative sources is the highest tribute paid to radiology since its very inception. While radiologists have always been proud of the marvelous progress of their specialty, they have refrained from any ostentatious demonstrations concerning its exalted position in medicine. On the contrary they have perhaps been too modest in proclaiming its many achievements. This may explain why so few of us know of the important position radiology occupies in the curricula of our medical schools. Even the Council on Medical Education of the American Medical Association apparently failed to appreciate fully its importance in this regard. A communication received from this body in 1930 in answer to an inquiry regarding radiologic teaching in medical schools, stated that most medical colleges do not require a student to take a course, or courses, in radiology. Most of them, the Council said, have short elective courses, either in the radiologic department or combined with medical clinics. Nor are there any requirements listed for radi-

ology in their publication, "Essentials of an Acceptable Medical College." They further state that all of the medical students receive some instruction in X-ray interpretation and this is continued in the interne, or fifth, year. The inference drawn from this communication was that radiology was not held in very high esteem by our medical schools. Yet we offer proof to the contrary.

There can be no argument as to the future of radiology in medicine, as it has established itself so firmly and become so indispensable that its continued progress can safely be predicted. In spite of the large number of hours now devoted to radiologic teaching, numerous medical schools believe that more time should be given this subject.

The present status of radiologic education is such that it should attract the attention of the Council on Medical Education of the American Medical Association, the National Board of Medical Examiners, the Federation of State Boards of Medical Examiners, the American College of Surgeons, the American College of Physicians, organized medicine, and organized radiology. All of these, by their kind consideration of the material contained in this issue of *RADIOLOGY*, can exert a tremendous influence in those States which have not as yet appreciated that a radiologist is a physician deserving of being considered on an equal basis with other members of organized medicine.

IN MEMORIAM

Arthur C. Heublem, M.D., died in Hartford, Connecticut, on April 8, 1932, at the age of 52, following a two months' illness from pneumonia, with complications.

Dr. Heublem became interested in radiology almost twenty-five years ago, and he devoted all his time and energy to this specialty until his death. He was a member of

all the radiological societies in this country, and on the staffs of several hospitals in Hartford and neighboring cities, either as attending radiologist or consultant. About two years ago he was appointed consulting roentgenologist to the Memorial Hospital, New York.

Those who knew Dr Heublein intimately were impressed by the unusual ability, earnestness, and sincerity which he exhibited in the practice of radiology. He was a true physician, ministering to the sick always to the best of his ability, and with the best interests of his patients at heart. The pleasure he derived from his work he regarded as sufficient compensation for his efforts.

On account of his innate modesty, Dr Heublein wrote few papers, although his knowledge of the subject and his personal contributions to it fully justified the publication of many more. He was actually distressed when his friends insisted that he read a paper at one of the radiological meetings.

Dr Heublein's keen analysis of the problems of radiation therapy and his ingenious methods of attacking them may be appreciated from the following examples. At the time when unfiltered glass "seeds" were used for interstitial radium therapy, and beneficial effects were attributed to the beta rays emitted by these seeds, Dr Heublein thought the beta rays were harmful and should be eliminated. Accordingly he conceived the idea of surrounding each glass seed in the tissue with a sufficient layer of bismuth paste to absorb the beta rays in the region where intense necrosis was produced by the seeds. He worked out a combination of trocar and syringe which made possible the practical application of this idea. After some preliminary experiments on animals, Dr Heublein treated some patients in this way both in Hartford and at the Memorial Hospital. The development of gold implants made the more complicated procedure with bismuth paste unnecessary but the fun-



The late Arthur C. Heublein, M.D.

damental idea is the same and is generally accepted to-day.

The experiment which best characterizes Dr Heublein's type of mind is the one which, indirectly, caused his demise. For years he had been disturbed by the poor end-results obtained by ordinary means of treatment in cases of generalized neoplastic disease, even of the radiosensitive type. He was convinced that the range of successful radiation therapy could be extended to include at least some of these patients, if the proper method were used. He set out to devise such a method, and he arrived at the following conclusions. Since tumors in these cases are apt to be present in any part of the body, the entire body should be irradiated. Furthermore, the irradiation should be such as to reach the deep structures. Hence a long target-skin distance and hard X-rays should be used. To avoid injury to

normal organs, while attempting to influence favorably the tumor processes, the patients should be irradiated with a very low intensity for a long time

Realizing that such a method of treatment could be given a thorough practical test only in a large cancer institution, Dr Heublein made arrangements with the Memorial Hospital to carry out this work. A suitable ward in which four patients could live in a beam of X-rays for two or three weeks at a time was constructed last year, and the first patients were treated in May. The clinical work has been carried out since then under the direct supervision of Dr Heublein and a special committee of the Medical Board.

Dr Heublein used to spend two days a week at the Memorial Hospital in connection with this work. He was so interested in the experiment that, without exaggeration, he spent the rest of the week in Hartford looking forward to his next visit to the Memorial Hospital. The last time he came to New York he was ill and was advised to return home immediately. But he stayed for another day, and a few days later hovered between life and death. He passed this crisis successfully, only to succumb eight weeks later.

Dr Heublein read a paper on his work at the Memorial Hospital at the meeting of the Radiological Society of North America in St Louis.¹ Since then, a great deal of interest has been shown in the experiment. Prominent radiologists in this country and abroad have said that the eyes of the radiological world are now focused on two experiments of equal importance. (1) The continuous irradiation of the entire body, and (2) the use of X-rays approaching the quality of gamma rays. The former has been referred to by some one as the "telepanirradiation method," but if such a term is to be used, the method will be known as the "*Heublein telepanirradiation method*"

As to personality and character, no adequate superlatives can be found to convey the proper meaning. And so this brief sketch may be concluded by saying that radiology has lost a lucid mind and devoted worker, and the world a real gentleman.

G. FAILLA, D.Sc.

ANNOUNCEMENTS

A MEMBER OF THE SOCIETY HONORED

The Royal Society of Medicine, of England, through its Secretary General, Mr Geoffrey R. Edwards, of London, has notified Byron H. Jackson, M.D., of Scranton, Pennsylvania, of his election as a Corresponding Honorary Member of the Society.

Others elected at the same time were Prof Gosta Forssell, of Stockholm, Sweden, Dr J. Murdoch, of Brussels, Belgium, Prof Dott Mario Ponzio, of Turin, Italy, Prof F. Haenisch, of Hamburg, Germany, and Prof H. R. Schinz, of Zurich, Switzerland.

The radiologists of America are particularly pleased to note that this eminent society has seen fit to select for such signal honor one who ranks so high in his own country as does Dr Jackson. The Radiological Society of North America likewise is sensible of the honor paid to its President-elect. The Journal tenders its congratulations.

INTERNATIONAL CONGRESS ON BILIARY LITHIASIS

This Congress will be held at Vichy Sept 19-22, under the presidency of Professor Paul Carnot. Of the four sections into which the program is divided, one is devoted to radiology and physiotherapy.

The program and full information may be obtained by writing to Dr J. Aimard, Secretary General, 24 Boulevard Capucines, Paris (IX), France.

¹Soon to be published.

CINCINNATI RADIOLOGICAL SOCIETY

The radiologists of Cincinnati have recently organized the Radiological Section of the Academy of Medicine of Cincinnati. Membership in this group is limited to those who practise radiology or roentgenology exclusively and who belong to the Academy of Medicine.

Informal monthly meetings are to be held in the various X-ray laboratories in the hospitals of the city. It is planned to present a radiological program before the entire Academy of Medicine each year. The officers for the current year are Samuel Brown, M.D., President, and Harold G. Reineke, M.D., Secretary.

CLEVELAND RADIOLOGICAL SOCIETY

The officers of the Cleveland Radiological Society are A. Strauss, M.D., President, and Merthyn A. Thomas, M.D., Secretary and Treasurer. The regular annual meeting takes place in May. Regular meetings are monthly on the fourth Monday. At each meeting a regular program is presented.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF RADIOPHERS

The annual meeting of the American Society of Radiographers is to be held at the Hotel Statler, St. Louis, May 24-27, 1932.

A most interesting program is being prepared. The following are to present papers on "Doctors' Day," Thursday, the 26th:

D. A. Rhinehart, M.D., of Little Rock, Ark.; Harold Swanberg, M.D., of Quincy, Ill.; P. C. Schnoebel, M.D., of St. Louis; Llewellyn Sale, M.D., of St. Louis; Arthur E. Strauss, M.D., of St. Louis; F. D. Gorham, M.D., of St. Louis; John S. Young, M.D., of East St. Louis; Duff S. Allen, M.D., of St. Louis; Bertram C. Cus-

way, M.D., of Chicago; Robert S. Landauer, Ph.D., of Chicago; and Robert A. Arens, M.D., of Chicago.

Edwin C. Ernst, M.D., of St. Louis, is to act as Toastmaster of the annual banquet (Thursday evening), with the following speakers: LeRoy Sante, M.D.; Paul C. Schnoebel, M.D.; Paul C. Titterington, M.D.; E. C. Jerman, D.Sc.; and R. E. Lee. The speaking is to be followed by entertainment, music, and dancing.

Many interesting subjects are to be presented by the Radiographers, including a chest symposium by the St. Louis Society of Radiographers on the opening afternoon. Wednesday evening there is to be a Round Table Discussion led by D. A. Rhinehart, M.D., assisted by E. C. Jerman, D.Sc., to which the Radiographers may bring their confusing problems and an attempt will be made to solve them. The whole meeting will be well worth the time of anyone wishing to attend.

VIRGINIA H. ELLER, R.T.,
Chairman of Program Committee

NOTE

Readers will note the omission of Abstracts of Current Literature from this issue. This does not indicate a future policy or any lack of material, but is done simply that more space may be devoted to the papers which constitute this Educational Number.

BOOK REVIEWS

TECHNIQUE DE L'OSTÉO-SYNTHÈSE, ÉTUDE DE QUELQUES PROCÉDÉS By ROBERT DANIS, Professor of Clinical Surgery, at the University of Brussels. A paper volume with 162 pages and 149 figures. Published by Masson et Cie, Paris, 1932. Price, 55 francs.

This book presents a method of open reduction of fractures by the use of sutures of non-oxidizable steel wire. Much detail of technic

is offered, adequately explained and well illustrated. The author has described a table which may be used not only for abdominal work but, with its various attachments, is suitable for all sorts of fracture work (Invented by Man, of Angiers). Special motor drills, instruments to pass the wires, and instruments to secure these as sutures are described. Finally, an instrument to fuse the ends of the wire sutures is described and its use illustrated.

Another form of fixation by a special screw with threads on the distal end and much wider spaced than usual is described, also a fixation material of wire mesh held with wires, all of non-oxidizing steel, is described.

With these combinations of methods the author is able to accomplish reduction of the various types of fracture by open method. He describes special apparatus for taking pre-operative as well as post-operative X-rays.

Some space is devoted to a description of bone-grafting technic in non-union. A specially devised motor saw is illustrated, the graft being held in place by autogenous bone screws. The graft is of the type known in this country as "inlay grafts." No case illustration of this method is given. The method is no doubt valuable in the hands of the author, but the complexity of the apparatus described and of the methods used makes its wide adoption unlikely.

LES TUMEURS DES OS (TUMORS OF BONE) By

J. SABRAZES, Professeur à la Faculté de Médecine, Chef de service au Centre Anticancéreux de Bordeaux et du Sud-Ouest

G. JEANNIN, Professeur agrégé à la Faculté de Médecine, Chirurgien adjoint au Centre Anticancéreux de Bordeaux et du Sud-Ouest, R. MATHEY-CORNAT, Électroradiologue des Hôpitaux, Chef de Laboratoire au Centre Anticancéreux de Bordeaux et du Sud-Ouest. Pages, 437, with 165 figures. Published by Masson et Cie, Paris, 1932. Price, 80 francs.

This volume covers in a concise and well-arranged manner the present knowledge of bone tumors. The authors have arranged the material in a manner somewhat different from the classifications accepted in this country.

However, their reasons for thus classifying these tumors are well stated and, in the light of our present knowledge, may be said to be as acceptable as any of the other classifications thus far offered. In the introduction the classifications of Codman (Registry Classification), Kolodny, Ewing, and Geschickter are given.

The authors have divided their book into three parts, as follows:

I. Benign bone tumors, *i.e.*, chondromas, osteomas, exostoses, fibromas, lipomas, myomas, and angiomas of bone.

II. Giant-cell tumors. This part includes also bone cysts and osteitis fibrosa.

III. Malignant bone tumors, primary and secondary, *i.e.*, osteogenic sarcoma, Ewing's sarcoma and myelomas or chloromyelomas, and, finally, metastatic tumors.

In each section there is a discussion of the historical aspects of that particular tumor, its clinical and pathological manifestations, including the roentgenographic findings, the value of biopsy, and the treatment, including surgery and X-radiation. Each type of tumor is considered as fully as its importance seems to justify. The authors quote freely from other writers and there is included a well-arranged and very complete bibliography on the subject of bone tumors. The illustrations consist chiefly of excellent roentgenograms which are amplified in each instance by an adjoining pen-and-ink sketch depicting the significant changes. The photomicrographs have not reproduced well and in some cases are rather disappointing.

The authors have attempted and have succeeded quite well in bringing the subject matter pertaining to bone tumors up to date. This is a very difficult task, since in treating of a subject like bone tumors, changing conceptions are constantly before us. However, as a text-book devoted to this subject, this book can be recommended as among those of first rank.

PRÉCIS DE RADIO-DIAGNOSTIC By P. LAMARQUE, Professeur agrégé à la Faculté de Médecine de Montpellier, with a Preface by PROF. E. FORGUE, Associé National de

l'Academie de Medecine, Membre correspondant de l'Institut There are 374 radiographs and explanatory line drawings supplementing the text (746 pages) Published by G Doin & Cie, Paris, 1932 Price, 125 francs

This book aims to serve as a text for students of radiology and as a reference book for general practitioners For that reason the purely technical aspects of radiography, description of apparatus, controversial questions, and citations of the literature are largely omitted by the author, being treated in a superficial way merely to emphasize some clinical point The presentation of the subject matter is so facile and concise that anyone knowing even the fundamentals of French can read the book with much profit In the first brief chapter (pages 1-13) apparatus is discussed The skeleton and its lesions are considered in the second chapter (pages 23-249) The respiratory system is considered in Chapter III (pages 253-361), the cardiovascular in the fourth chapter (pages 363-398) The chapter on the gastro-intestinal tract covers pages 403-598, the seventh chapter (pages 601-636) concerns itself with the urinary tract, and the eighth (pages 639-668) the genital The "specialties" are next discussed briefly otorhinolaryngology on pages 671-684, ophthalmology on pages 685-690, neurology on pages 693-706, and stomatology on pages 707-715 In each chapter the normal is presented as a basis of comparison with the pathologic both in the text and in the reproductions of radiographs, each of which has an explanatory line drawing As far as the reviewer knows, this is the best single-volume presentation of the subject to the student or beginner in radiology, yet the specialist may well read the book with profit

The make-up of the book is first-class, though it does suffer from the mediocrity of many of the cuts It rather seems that it would have been worth while to make many of them full, rather than half, page in size, which fault will undoubtedly be corrected in future editions

TUMORS OF THE BREAST THEIR PATHOLOGY, SYMPTOMS, DIAGNOSIS, AND TREATMENT By SIR G LENTHAL CHEATLE, KCB, CVO, FRCS, Consulting Surgeon and Emeritus Lecturer on Surgery, King's College Hospital, London, Late Surgeon to and Lecturer on Surgery at King's College Hospital, London, Walker Prizeman, 1926-1930, and MAX CUTLER, BSc, MD, Director of Tumor Clinic, Michael Reese Hospital, Chicago, Late Clinical Fellow, Memorial Hospital, New York, Director of Research Division of Cancer Department of Hospitals, New York, Attending Radiation Therapist, New York City Cancer Institute J B Lippincott Company, Philadelphia, 1931 Pages 596, with 18 colored plates and 468 other illustrations Price \$12

This massive volume is the most recent and probably the best comprehensive study published on breast tumors The contents, collected from the literature and from thirty-five years of experience, reveals a wealth of material which is of inestimable value to all students of breast pathology The compilation of this material bespeaks tedious, persevering, and concentrated effort

The book is subdivided into fourteen chapters, each containing a complete bibliography The long, tedious discussions and occasional repetitions sometimes carry the reader far away from the original trend of thought and leave him with uncrystallized ideas

The microscopic, whole breast sections giving the detailed location and extent of tumefactions, together with the histopathological picture of the surrounding tissues, are one of the most attractive features of the book They are distinctly an advance in the study of breast pathology

The division of epithelial growths into desquamative hyperplasia and neoplasia is an interesting feature of the new classification Desquamative hyperplasia includes mazoplasia and cystiphorous changes Mazoplasia comprises the more physiological tumefactions of "chronic cystic mastitis" and may be treated by ovarian residue Cystiphorous desquamative epithelial hyperplasia is considered as the

other phase of desquamative hyperplasia and is distinguished from mazoplasia by its susceptibility to undergo benign and malignant changes. The malignant change is reported to be 20 per cent of all cases of breast carcinoma.

Cysts are believed to arise in the acini and carcinoma to arise in the ducts. Small cysts, which are usually seen in multicystic conditions, are more susceptible to benign and malignant changes. Because of the possibility of carcinoma arising in cystiphorous changes of the breast, these changes are considered as menacing neoplastic states and are treated by routine mastectomy, if malignancy is found, they are treated by radical amputation. Frozen sections are made after the removal of the breast.

All papillomas are believed to ultimately become malignant. A single papilloma is considered as having a bad prognosis for, unless a whole section of the breast be examined microscopically it is impossible to say that the growth is single. When removed, the stimulus causing the first papilloma may cause the formation of others, and for these reasons, a papilloma is regarded as a pre-cancerous condition and is treated by mastectomy.

The discussion of carcinoma is based on the location of the growth and is presented fully from the angles of histopathology, modes of extension, grades of malignancy, radiosensitivity, diagnosis by inspection, palpation, transillumination, and biopsy and treatment by surgery and irradiation. The diagnosis of carcinoma is rendered according to the cellular pathology regardless of the presence of intact basement membranes. A few such cases showing metastasis are demonstrated by the au-

thors. The differential diagnosis covers the major field of breast pathology.

Transillumination is thoroughly discussed. The points of differentiation between cystic, papillomatous, and solid tumors are made clear and a warning against over-illumination given.

Paget's disease of the nipple is amply covered by seventeen beautifully illustrated and completely worked up cases. The disease is considered as a primary one and though there seems to be a relation between duct carcinoma and Paget's disease, carcinomatous changes occurring in the breast are considered as spontaneous and independent.

Sarcoma occurs in from 2 to 39 per cent of breast tumors. Round-cell sarcoma is considered the most malignant and giant-cell sarcoma the least malignant. The majority of the sarcomas are radioresistant, but some are highly radiosensitive.

Irradiation, in general, more quickly affects anaplastic lesions. In carcinoma of the breast a small number of cases show great radiosensitivity, but the majority show slight, and, in a small number of cases, no radiosensitivity. In spite of the fact that cure in late cases, occurring in old individuals, cannot be effected, a growth restraint, by sublethal doses can be produced. Finally, it is admitted that irradiation is still in the experimental stage.

The book is an excellent survey of breast tumors and clearly demonstrates the degree to which breast pathology has become specialized. It is not the book for a novice, but nevertheless should prove an invaluable aid both as an atlas and as a reference to students, practitioners, and specialists.

JOHN G. MENVILLE, M.D.

WANTED—Radiologist with two and one-half years' training in two well known Eastern hospitals desires full or part time connection with institution. Best of references. Address D-4, care RADIOLOGY

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RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA

VOL XVIII

JUNE, 1932

No 6

A PRELIMINARY REPORT ON CONTINUOUS IRRADIATION OF THE ENTIRE BODY¹

By ARTHUR C HEUBLEIN, M.D.,² HARTFORD, CONNECTICUT

THE purpose of this paper is to present a new method of X-ray therapy consisting of continuous irradiation of the entire body at long distances from the tube. The following considerations have led the writer to the belief that this method may prove valuable in the treatment of certain types of neoplastic diseases.

1 As stated in the law of Bergonié and Tribondeau (1), "Immature cells and cells in an active state of division are more sensitive to the X-rays than are cells which have already acquired their fixed adult morphologic and physiologic characters."

A corollary of this law is that treatment should extend over a period sufficiently long to include the various times of mitosis of all the cells of the tumor. Under these conditions, it is supposed that, although a low intensity of radiation is necessitated by the long treatment, the dose received by the cancer cell at the time when it is most sensitive nevertheless is sufficient to destroy it or arrest its growth.

2 Dr Ewing (2), in his Caldwell Lecture, states "It is no longer possible to maintain that the body furnishes no aid in radiation therapy Effective irradiation

excites a favorable reaction on the part of the body as a whole. The nature of this reaction is complex and the factors are largely unknown. It is probably of much importance in the cure of malignant tumors by radiation." He further states, "The immediate improvement in health and strength in leukemic subjects following irradiation suggests some such action."

The biologic work of Kok and Vorlaender (3) and of Caspari (4) shows the importance of generalized body irradiation in that a considerably smaller part of a skin erythema dose is required to cause tumor regression than is necessary for equal regression of tumors treated locally. Similarly, the work of Murphy and Nakahara (5) shows that irradiation of the entire body of cancer mice stimulates a defense mechanism against cancer invasion.

3 Physical considerations demand as an ideal the most uniform distribution of radiation throughout the tissues undergoing treatment. Uniformity of distribution is necessary in order to take full advantage of the relative radiosensitivity of normal and neoplastic tissues.

4 Certain types of neoplastic diseases, which tend to become widely disseminated early in their course, cannot be controlled effectively by the usual local treatments. Since the early stages of such dissemination are often unrecognizable, and since the ear-

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St Louis Nov 30-Dec 4 1931

²Dr Heublein passed away before proof of this paper could be submitted to him. It has been read by his friend, G. Tailla D.Sc. of Memorial Hospital, New York City. A sketch of Dr Heublein's life and work will be found in the May 1932 issue of RADIOLOGY.

liest possible treatment of metastases offers the best chance for their control, it appears that the greatest hope of success in treating these cases lies in the irradiation of the entire body

A practical method of treatment, based on the above considerations, involves the prolonged irradiation of the whole body with very hard X-rays at long target-skin distances. The question of the optimum duration of treatment immediately arises. While very little is known about this, we may, perhaps, get some information from experience in the usual radiation therapy.

In radium therapy, prolonged irradiation of low intensity is usually necessitated by the small quantity of radium available. In the use of permanent gold implants, where the major portion of the dose is delivered over a period of two weeks, the good results obtained may be attributed, at least in part, to the long irradiation time. Regaud, who has stressed the value of prolonged irradiation by means of needles of small radium content, recommends a treatment lasting about one week.

In roentgen therapy, at the Radium Institute of the University of Paris, divided treatments are used over a period of about three weeks. Pfahler's saturation method may be regarded as a variant of this technic. Twenty-five years ago, satisfactory and permanent results were obtained in the treatment of superficial skin neoplasms when small divided X-ray dosage, over long periods of time, was the only method of irradiation known. In the absence of any more definite information, it would appear that, in the method of continuous irradiation of the whole body, the duration of treatment should be between one and three weeks, at least in the beginning.

In the choice of the radiation to be used, one is limited by the X-ray tubes which can be obtained readily. For continuous operation, it is preferable not to run the tube at

its maximum rated capacity. At 185 K.V. and 3 ma, ordinary tubes work very well. With a filter thicker than 0.5 mm. of copper, the radiation is hard and quite homogeneous.

In order to obtain a nearly uniform distribution of radiation throughout the body, the target-skin distance should be long, in comparison with the thickness of the body. For the economic utilization of X-ray equipment it is desirable to treat several patients simultaneously. These two requirements can be met by having several patients in a room so planned that all are farther than 5 meters from the tube. To secure the desired prolongation of continuous treatment to one week or longer, at the same time restricting the dose to a safe amount, it is necessary to adjust the intensity of radiation received by the patient to the proper value. This can be done by a suitable choice of filter and distance, other conditions remaining constant.

Irradiation of the entire body with hard rays and at a very long distance, so that all parts of the body receive nearly the same dosage, is a new procedure. Simultaneously irradiating the entire hematopoietic and reticulo-endothelial systems, as well as the various glands of internal secretion, might lower the patient's vitality. Since the tolerance doses under these conditions are unknown, if we attempt to apply the above principles it is necessary to proceed cautiously. In the past, all portions of the body have been heavily irradiated in sections, without serious permanent damage being observed. It is a different matter, however, to irradiate them all simultaneously. Nevertheless, there must be some safe dose, tolerated by the whole body, which may be sufficient to produce beneficial results. Very radiosensitive tumors, one would expect, could probably be controlled by such a dose of radiation, acting directly upon the tumor cells. The more resistant tumors might

conceivably be controlled by an unknown, indirect mechanism, such as some influence on glandular structures, the circulating blood, the reticulo-endothelial system, or possibly the tumor bed, together with direct effect on the tumor cells, whereas either mode of action alone might not be sufficient to cause regression.

Reports have appeared in the recent European literature referring to *intermittent* treatment of the entire body or prolonged treatment of parts of the body. These reports, which are also encouraging as to the results that may be hoped for, may serve as a guide in deciding the dose to administer with the new procedure.

Tomanek (6) reports a case of myelogenous leukemia which responded brilliantly to prolonged irradiation of the spleen by means of the continuous application of radium for a period of three weeks. The patient, who had ceased to respond to small divided doses of X-rays, was in the terminal stage of the disease when continuous irradiation was begun.

Fuhs (7) has been using roentgen irradiation of the entire body in long continued or resistant dermatoses, with promising results.

In skin tuberculosis, Thedering (8) has used a "roentgen bath," combined with the usual therapeutic measures. He has reported satisfactory results.

Teschendorf (9) has irradiated the entire body in various forms of leukemia and in malignant granuloma. He has noted greater remission periods in these diseases than by using small ports in the ordinary way.

Chaoul and Lange (10) reported promising results in their treatment of Hodgkin's disease with generalized roentgen irradiation in weak doses. Twelve advanced cases so treated showed restoration of the patients to their full working capacity. Of these, 80 per cent have remained free from recurrence on an average of about two and one-

half years. The remaining 20 per cent died of intercurrent disease after intervals of from eight months to two and one-half years.

In the chronic, slowly developing forms of Hodgkin's disease, Schwarz (11) obtained excellent results with small protracted roentgen-ray dosage, giving from 8 to 10 treatments in 14 days. Finding that massive dosage given in one treatment had very little effect, he explained this by the hypothesis that a large number of cell areas may, at a given time, be in a condition of metabolic inactivity and, consequently, have a very low radiosensitivity. He concluded that small doses given over a protracted period have a greater chance to catch all the cells at the best moment for their destruction.

Frimann-Dahl and Forsberg (12) used interrupted dosage directed to the entire body in the leukemias, with the head, neck, and genitals screened. The exposures were from 12 to 18 minutes at one meter distance. They delivered from 0.1 to 0.8 of an erythema dose in a period of from four or five days to five weeks, using daily exposures. These authors maintain that general irradiation is superior to local roentgenotherapy because it is more lenient, enabling the patient to keep up his work longer.

For several years, the author has had in mind the practical application of the above-mentioned method of radiation therapy. The problem, however, requires intensive study of its different aspects, which can be best carried out in a well-organized cancer center. For this reason a co-operative arrangement was made with the Memorial Hospital, of New York, to initiate the work under the proper auspices. The necessary equipment was installed in May, 1931. The clinical work has been conducted under the direction of a special committee of the Hospital on experimental roentgenotherapy in co-operation with the author.

The X-ray machine employed was spe-

liest possible treatment of metastases offers the best chance for their control, it appears that the greatest hope of success in treating these cases lies in the irradiation of the entire body

A practical method of treatment, based on the above considerations, involves the prolonged irradiation of the whole body with very hard X-rays at long target-skin distances. The question of the optimum duration of treatment immediately arises. While very little is known about this, we may, perhaps, get some information from experience in the usual radiation therapy.

In radium therapy, prolonged irradiation of low intensity is usually necessitated by the small quantity of radium available. In the use of permanent gold implants, where the major portion of the dose is delivered over a period of two weeks, the good results obtained may be attributed, at least in part, to the long irradiation time. Regaud, who has stressed the value of prolonged irradiation by means of needles of small radium content, recommends a treatment lasting about one week.

In roentgen therapy, at the Radium Institute of the University of Paris, divided treatments are used over a period of about three weeks. Pfahler's saturation method may be regarded as a variant of this technic. Twenty-five years ago, satisfactory and permanent results were obtained in the treatment of superficial skin neoplasms when small divided X-ray dosage, over long periods of time, was the only method of irradiation known. In the absence of any more definite information, it would appear that, in the method of continuous irradiation of the whole body, the duration of treatment should be between one and three weeks, at least in the beginning.

In the choice of the radiation to be used, one is limited by the X-ray tubes which can be obtained readily. For continuous operation, it is preferable not to run the tube at

its maximum rated capacity. At 185 K.V. and 3 ma., ordinary tubes work very well. With a filter thicker than 0.5 mm. of copper, the radiation is hard and quite homogeneous.

In order to obtain a nearly uniform distribution of radiation throughout the body, the target-skin distance should be long, in comparison with the thickness of the body. For the economic utilization of X-ray equipment it is desirable to treat several patients simultaneously. These two requirements can be met by having several patients in a room so planned that all are farther than 5 meters from the tube. To secure the desired prolongation of continuous treatment to one week or longer, at the same time restricting the dose to a safe amount, it is necessary to adjust the intensity of radiation received by the patient to the proper value. This can be done by a suitable choice of filter and distance, other conditions remaining constant.

Irradiation of the entire body with hard rays and at a very long distance, so that all parts of the body receive nearly the same dosage, is a new procedure. Simultaneously irradiating the entire hematopoietic and reticulo-endothelial systems, as well as the various glands of internal secretion, might lower the patient's vitality. Since the tolerance doses under these conditions are unknown, if we attempt to apply the above principles it is necessary to proceed cautiously. In the past, all portions of the body have been heavily irradiated in sections, without serious permanent damage being observed. It is a different matter, however, to irradiate them all simultaneously. Nevertheless, there must be some safe dose, tolerated by the whole body, which may be sufficient to produce beneficial results. Very radiosensitive tumors, one would expect, could probably be controlled by such a dose of radiation, acting directly upon the tumor cells. The more resistant tumors might

hours This apparatus requires no X-ray technician to operate it, and the attending nurses are protected from exposure to X-rays by an automatic cut-out switch, which stops operation of the tube as soon as the door of the treatment room is opened The time that the machine is shut down is automatically registered A graph indicates the intensity of X-radiation emitted at all times The machine, which has been in constant operation since May, 1931, has required practically no attention

Our first X-ray tube, the old Coolidge deep therapy type, ran 768 hours before breaking down A new type Coolidge therapy tube with hard glass was substituted This has operated continuously up to November 5 for 2,161 hours, and is still functioning perfectly The current consumption has been 26 kilowatt-hours per day, entailing an expense of from \$1.00 to \$1.25

With one Coolidge tube, five patients are simultaneously irradiated, four continuously at long distances, and one at comparatively short range, 150 centimeters In the main ward in which there are four beds, the average distance to the far beds is 732 cm, approximately 24 feet, and, to the two near beds, 548 cm, approximately 18 feet The time required to administer a given dose, kilovoltage and milliamperage being constant, depends upon the thickness of the filter and the distance employed Up to the present, several different dosages have been used with varying irradiation times The tube has been operated at 185 KV and 3 ma so far With a filter of 2 mm of copper, the intensity of radiation at the near beds is 1.26 r per hour, at the far beds, it is 0.68 r per hour, measured in air Accordingly, to deliver 25 per cent of an erythema dose (that is, 25 per cent of 750 r) a patient in a near bed must be irradiated for 149 hours (or about 7.5 days at 20 hours a day) To receive the same dos-

age a patient in a far bed must be irradiated for 278 hours (or 13.9 days at 20 hours a day) Initially, a much heavier filter (5 mm copper) was employed in order to reduce the intensity of radiation, so that smaller percentages of an erythema could be administered without reducing the time factor

Although the lethal X-ray dose for a canary is unknown, on May 26, one was placed in a cage in the X-ray room with the patients, one-half the distance to the far beds This was done to give an indication of the possible harmful effects of prolonged irradiation Up to November 5, this canary had received a total of 5,000 r, or 6.3 skin erythema doses A second canary, used as a control, was placed outside the X-ray beam, receiving only a small amount of scattered radiation Both are still alive and are apparently in as good condition as when we started³

As this work is largely experimental, it has been necessary to proceed with the utmost caution and to increase doses slowly, starting with 5 per cent of a skin erythema and gradually increasing to 30 per cent This dose will be increased from time to time, if no harmful effects are observed

It has been our feeling that beneficial effects might be hoped for in the following groups of cases

- 1 The leukemias
- 2 The lymphomas
- 3 The radiosensitive carcinomas

At first, however, the main purpose was to establish a dose the entire body could safely tolerate Accordingly, cases which one would expect to influence favorably by any of our present well established methods of treatment were excluded All patients receiving treatment by this method presented a wide dissemination of their disease Many had radioresistant tumors

³The first canary died later after receiving about 7 erythema doses At autopsy it showed marked radiation changes

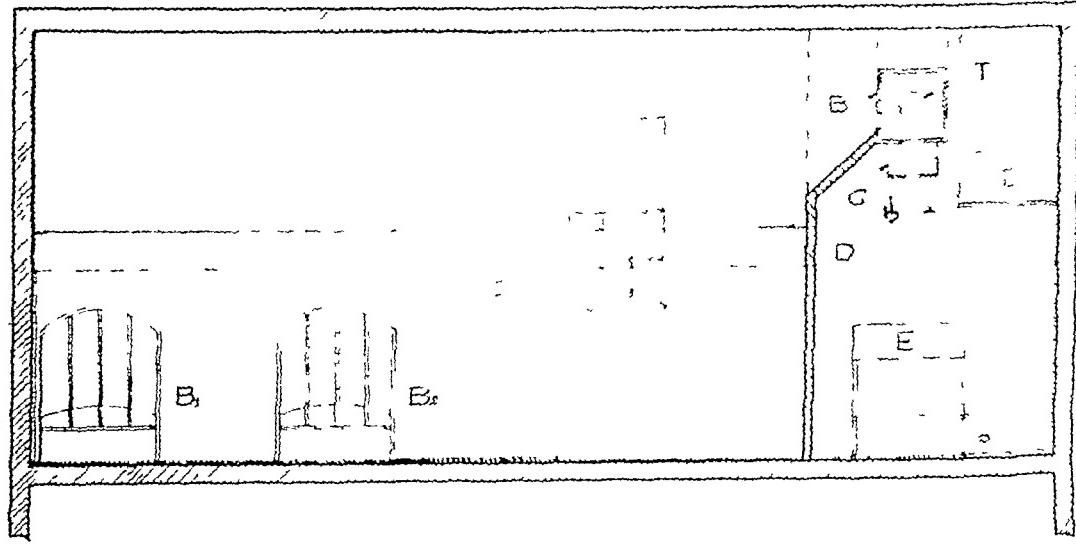
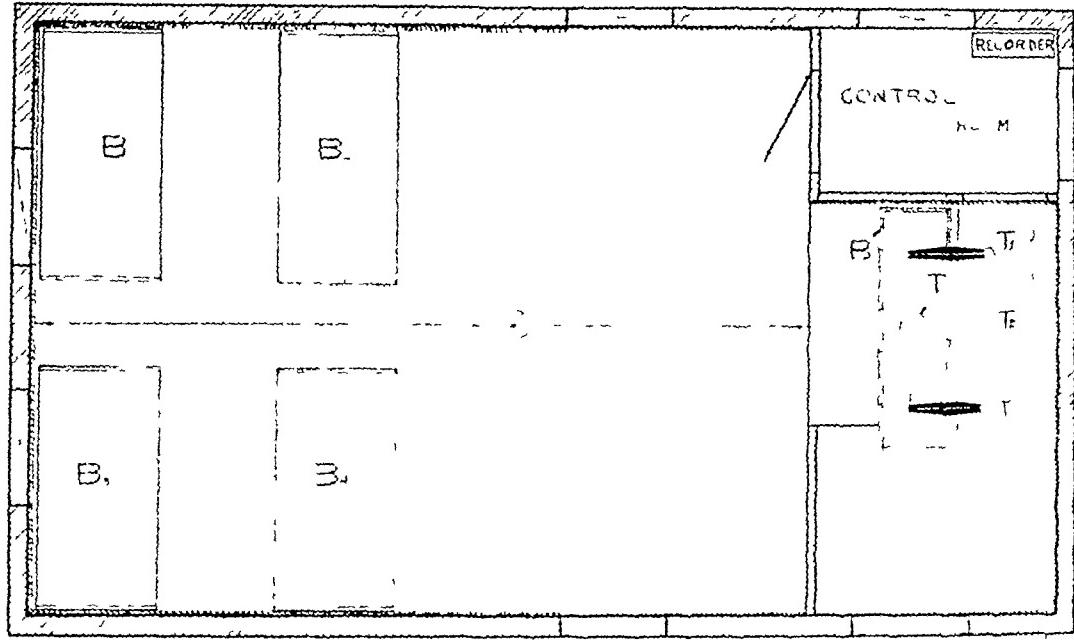


Fig 1 A schematic drawing of the lead-lined radiation ward. Here, with a single X-ray tube, irradiation of the entire body at long distances, as well as interrupted treatment at shorter distances, may be carried on continuously.

cially designed according to specifications drawn up by Dr G Failla. It is silent and automatic, and permits the continuous operation of a roentgen tube, day and night,

except for such time as is required for the necessary nursing care of the patients. In practice, we have found that the machine operates approximately 20 out of the 24

in the abdomen became slightly larger. The patient was able to resume work.

UNIMPROVED CASES (RADIOSENSITIVE GROUP)

Five patients were unimproved; one with lymphosarcoma, one with lymphatic leukemia, one with Hodgkin's disease, one with lymphatic pseudoleukemia, and one with myeloid leukemia. The first four received, respectively, 5.4, 5.9, 15.2 and 15 per cent of an erythema dose. The patient with myeloid leukemia, who received 15 per cent, has been too recently treated for us to draw any conclusions.

The remaining four patients in this group died; one had subacute Hodgkin's disease, one, chronic Hodgkin's disease, one, a lymphatic pseudoleukemia, and one lymphosarcoma. They received, respectively, 5.6, 6, 10, and 25 per cent of an erythema dose. The deaths in these cases could not be directly attributed to this therapeutic procedure. One died of bronchopneumonia, and three of the natural progress of their disease.

RADIORESISTANT GROUP

There were eight patients who were treated at long distances. Two showed symptomatic improvement.

A patient who had an adenocarcinoma of the breast, with metastases to the lungs and lumbar spine, received 15 per cent of an erythema dose. In this case there was considerable relief from pain caused by bone metastases.

A patient who had carcinoma of the breast with widespread metastases to the lungs, lumbar spine, and pelvis received 15 per cent of an erythema dose, resulting in relief from pain caused by bone metastases.

Of the unimproved patients, there were three who had metastatic carcinomas of the breast. One received 8.4 per cent of an erythema dose and two received 15 per cent.

The fourth patient, who presented metastatic melanoma, received 30 per cent of an erythema dose. However, he has been treated too recently to permit one to draw any definite conclusions.

The other two patients in this group died. One had a widespread metastatic squamous-cell carcinoma of the left renal pelvis and died of coronary thrombosis. The other had a carcinoma of the breast with metastases to the lung. They received 6 and 15 per cent of an erythema dose, respectively.

A thorough physical examination, tumor measurements, basal metabolism estimate, blood pressure, and routine urine examination are made on all patients treated by the continuous method before they are admitted to the treatment ward. Special laboratory tests are as follows:

- 1 A biopsy specimen
- 2 Blood Wassermann
- 3 Blood calcium
- 4 Blood phosphorus
- 5 Blood sugar
- 6 Non-protein nitrogen
- 7 Blood CO₂ combining power
- 8 Blood P_H
- 9 Icterus index
- 10 Complete blood count
- 11 Fragility test
- 12 Platelet count

A careful follow-up system is maintained of these tests, which are made before, during, and after the treatment. In this small series, no changes attributable to the treatment were noted in any of the tests. Thus, valuable information of the tolerance dose has been accumulated, based on the general reaction of the body.

The results obtained so far, with the continuous long distance method of treatment, are not striking, but some definite evidence of improvement has been noted, particularly in the patients with radiosensitive neoplastic disease who have received the higher dosages. In this connection, it should be noted

From the latter part of May, when the first patient was placed in the X-ray ward, until the middle of October, 20 patients were treated at long distances. The doses delivered varied from 5 to 30 per cent of an

Following the first course, in which 87 per cent of an erythema dose was delivered, the patient showed improvement, evidenced in the regression of his nodes and a feeling of general well-being. Three months later, he



Fig 2. Photograph of the ward for continuous irradiation of the entire body at long distances.

erythema, only one receiving this latter dose. Of the 20 patients treated at long distances, 12 are classified in the radiosensitive, and eight in the radioresistant group.

RADIOSENSITIVE GROUP

- 1 Two cases of lymphosarcoma
- 2 Four cases of Hodgkin's disease
- 3 Six cases of leukemia
 - (A) One myeloid
 - (B) Two lymphatic
 - (C) Three lymphatic pseudoleukemia

Two of the patients in this group showed distinct improvement and a third was moderately benefited.

IMPROVED CASES (RADIOSENSITIVE GROUP)

A patient with widely disseminated lymphatic leukemia, with a mass in the abdomen, received two courses of treatment

was admitted for a second course of treatment, receiving at this time 16.3 per cent of an erythema dose, a total of 25 per cent of an erythema dose for both courses. This patient showed satisfactory progress as far as a general feeling of well-being was concerned, a gain in weight, and almost complete regression of his nodes.

A patient having Hodgkin's disease with widely distributed nodes and a mass in the abdomen, who received 15 per cent of an erythema dose over a period of 253 hours, showed distinct improvement in general well-being. The nodes regressed appreciably in size and the patient gained in weight.

A patient, having lymphatic leukemia with widely distributed nodes and a mass in the abdomen, received 15 per cent of an erythema dose. This was followed by a general improvement in well-being and diminution in the size of the nodes, although the mass

administered With proper precautions, this can be done without danger of exceeding the safety limit

In order to utilize the X-ray machine to its full extent, a treatment table was placed beneath the tube in a separate room Here patients received intermittent treatments at 150 cm distance through ports 27 cm in diameter, or smaller, if desired The X-ray beam is filtered through 1 mm copper and 4 mm aluminum As the intensity delivered is 306 r per hour, it requires 24.5 hours to deliver 750 r Two ports cover one side of the entire torso The depth dose at 10 cm with this field is 58 per cent

At this shorter distance (150 cm), 10 cases were treated with interrupted dosages, delivering 61.2 r through each of two ports daily until a total of from 750 to 1,000 r to each port had been attained The time consumed is approximately from 12 to 24 days

A total of 10 cases, four radiosensitive and six radioresistant, were treated as follows

Radiosensitive Group—1 A patient who had a recurrent teratoma testis, who has received prophylactic radiation directed to the abdomen, has remained well for four months Previously radium had been used for recurrences in the scar, causing their complete regression

2 A patient with recurrent teratoma testis with a large mass in the abdomen, which resisted high voltage treatment one month before the present treatment, showed complete regression of the tumor He has remained well for four months

3 A patient with a very extensive Grade IV carcinoma of the neck of the urinary bladder, with metastases to the lung, showed complete regression of the tumor masses in the lung in six weeks from the beginning of the treatment There was also marked improvement in the size of the bladder tumor which has regressed to one-third its former size This patient received 800 r to

the chest and abdomen anteriorly and posteriorly so that the whole torso was covered A second course of treatment is now being given When admitted for treatment, this patient appeared to be in a terminal stage of his disease and received repeated blood transfusions In spite of his generally bad condition, the tumor regression has been most satisfactory

4 A patient who exhibited an advanced lymphosarcoma with metastases to the pubic bones, to the nodes, and mediastinum, showed no distinct improvement

Radioresistant Group—1 No improvement was noted in an adult type teratoma testis with widespread metastases to the lung and abdomen

2 Two carcinomas of the urinary bladder, Grade II, showed no regression after receiving 1,000 r anteriorly and posteriorly

3 A carcinoma of the cardiac end of the stomach showed no improvement This diagnosis was based on clinical and X-ray findings only

4 A primary Grade II carcinoma of the lung showed no improvement

5 A hypernephroma with metastases to the lungs showed no improvement

To date the results with the short distance intermittent technic, while more striking than the long distance method, may be accounted for by the greater total dosage delivered The number from which to draw conclusions, however, is too small

SUMMARY

1 Theoretic considerations and practical observations led the author to the conclusion that it is desirable to test the value of prolonged continuous irradiation of the entire body in certain types of neoplastic diseases

2 At the Memorial Hospital, an automatic X-ray machine is in use in a special lead-lined ward in which four patients may be simultaneously and continuously irradiated

that the maximum total dose administered so far is probably too low, since it has produced no detectable blood changes. Furthermore, all the patients selected for this

mode of treatment have been in the advanced stages of their diseases. Accordingly, it is desirable to continue the experiment and to increase gradually the total dose.

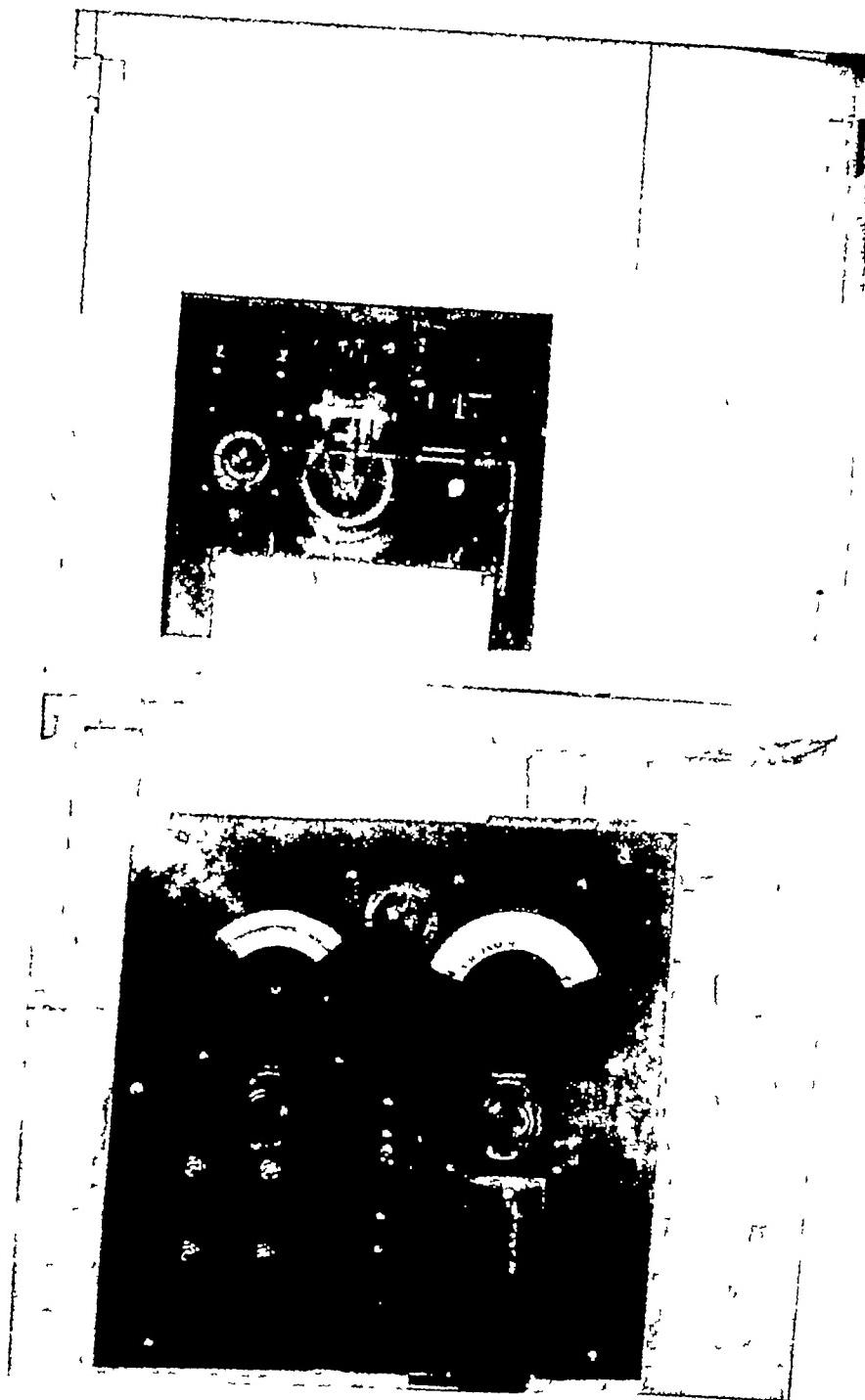


Fig. 3 Panel board of X-ray control and recording meter

DISCUSSION

DR. L. F. CRAVER (New York City) I would emphasize three points in connection with this work. They are the method is new, it appears to be safe, within limits, and it appears to be valuable.

When this method was first proposed to us at Memorial Hospital, it encountered a feeling of considerable skepticism and uncertainty. So many biologic factors are involved about which little is known that we felt obliged to begin with very small doses and to proceed cautiously, watching the condition of the patients carefully. Particularly we made frequent counts of the blood cells and blood platelets, together with numerous other laboratory tests, so that, as far as possible, we might avoid exceeding the body tolerance dose. It should be emphasized that, up to the present time, our selection of patients for this form of treatment has been purposely restricted to those whose prognosis was hopeless with any other form of therapy.

We began seven months ago with 5 per cent of a skin erythema dose, and have found ourselves able to increase this gradually by successive steps to 10, 15, 25, 30, 40, and even 50 per cent. To our surprise, frequently repeated blood counts and other tests have, in all instances, failed to show any consistent change that could be ascribed to radiation effect, except in the leukemias, in which the usual decrease in the number of white cells has occurred. There has been no instance of marked drop in blood platelets nor has purpura hemorrhagica occurred in any case.

As to changes in the menstrual function, only three women were below the menopause age. One of these was a young woman with generalized Hodgkin's disease, in whom the menses had been suppressed for several months before she was treated. In her case, apparently the disease itself had caused the amenorrhea. The other women who were still having menstrual periods have been treated too recently to permit observations as to the effect of the treatment on this function. No attempt has been made to shield the eyes, hair of the scalp, or genitals.

To sum up, then, the safety of the method,

we feel certain that, with doses up to 50 per cent of a skin erythema, delivered to the entire body with the factors of distance and filtration which we are using, no deleterious effects have been detected. How much further we can increase the dose we do not know. That is the part of the problem that lies immediately before us.

The method promises to be valuable. Thus far, 27 patients have been treated. There were 15 in the radiosensitive group, and 12 in the radioresistant group. The radiosensitive group comprised one case of myelogenous leukemia, three of lymphatic leukemia, four of pseudoleukemia, five of Hodgkin's disease, and two with lymphosarcoma. In the radioresistant group there were five with carcinoma of the breast with metastases to the bones or lungs, or both, one with squamous carcinoma of the renal pelvis with extensive lymph node metastases, one ovarian carcinoma with extensive lymph node metastases, three of metastasizing melanoma, and one with widespread metastases in the bone from a prostatic carcinoma.

Four of the patients in the radiosensitive group died, all, we believe, of the natural progress of the disease. Three patients in the radioresistant group died, one of acute cardiac failure, the other two of the natural progress of the disease. None of these deaths, so far as we could see, could in any way be ascribed to the effects of the treatment.

We have noted some distinct beneficial effects, particularly with the larger doses. Two of the patients with metastasizing cancer of the breast involving bones had relief from pain. The patient with metastasizing prostatic carcinoma, who received recently a 50 per cent dose, has had considerable relief from pain, accompanied by a distinct improvement in general condition.

It is particularly in the radiosensitive group, however, that we have, in some instances, seen striking improvement. One recent case—pseudoleukemia, with generalized lymphadenopathy and bilateral parotid and temporal tumors—showed regression while under treatment. This regression has continued and the patient is markedly better in general condition.

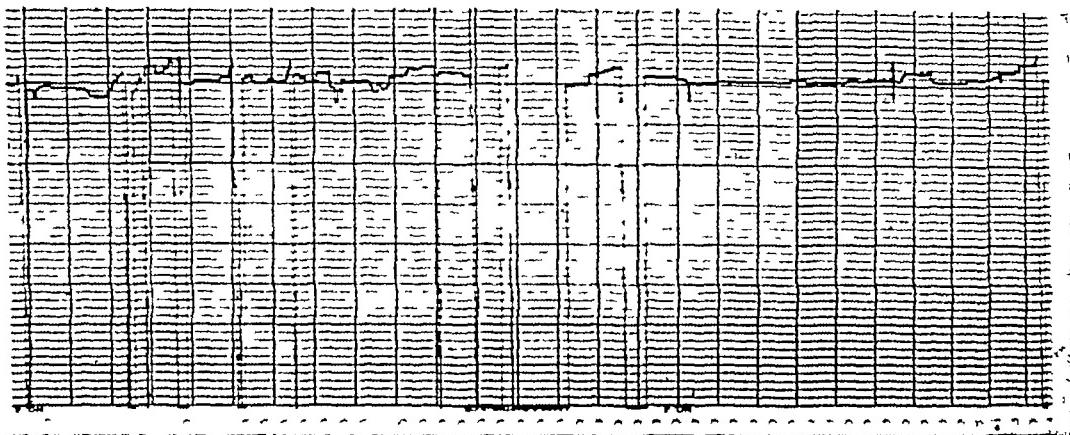


Fig 4. A graph indicating the intensity of X-rays emitted, as well as the periods and length of time of interruptions in the treatment

ated. In addition, provision has been made for the administration to other patients of local intermittent treatments at a target-skin distance of 150 cm, making use of the same X-ray tube. This machine is dependable and economical in operation.

3 The cases selected for the long distance irradiation method are well advanced, and many present widely disseminated lesions. This choice is made primarily to establish a tolerance dose for the entire body, and in the hope of observing some beneficial clinical manifestation, such as a stimulation of some defense mechanism against malignant disease.

4 The maximum dose which the entire body will tolerate has not yet been established. However, investigations to determine this dose are being carried on. At present, we believe that 25 per cent of a full erythema dose of 750 r measured in air, delivered at the rate of 126 r per hour, is a safe dose. Clinical observations and extensive special laboratory tests confirm this opinion.

5 To date, no pronounced beneficial clinical manifestations have become evident, although in some instances encouraging improvement has been noted. It is too early

to say whether or not a favorable systemic effect has been, or can be, produced by this method.

6 With intermittent local treatment at 150 cm, definite regressions have been noted in the radiosensitive group of cases.

7 The number of cases in both groups is too small to permit any definite conclusions at this time, although it is believed that the evidence accumulated thus far fully warrants the continuation of the experiment with increasing dosage, within safe limits.

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CANCER IN THE YOUNG

By M J SITTENFIELD, M D, NEW YORK

THE popular conception of a definite cancer age has overshadowed the actual fact that cancer occurs quite frequently in the young. The occurrence of cancer in childhood has been distinctly underestimated and its rarity very much exaggerated, an attitude which really accounts for its scanty mention by most writers. It is my belief, however, that much more attention should be accorded this chapter of malignancy, both by the cancer student and also the clinician. For example when isolated cases of cancer in the young are reported in the literature, it is surprising to note that these neoplasms are described usually in the terminal stage, or at a period when widespread metastases compel recognition, especially tumors which belong to certain well defined groups. Obviously a great many are overlooked, because it is the common experience that when a single neoplasm in a child is reported, within a comparatively short time a surprisingly large number of similar cases are described.

In a survey of cancer in the young, it is particularly noticeable that writers who have given much thought to this subject generally record a remarkably large number of cases.

Cushing (1) for instance, cites that out of 1,108 cases of intracranial tumors in his service at the Peter Bent Brigham Hospital, in Boston, from 1913 to 1926, 20 per cent occurred during the first two decades of life. He further states that half of these tumors should have been diagnosed at the bedside, and postulates, in his series, a definite clinical syndrome. He suggests that the recognition of certain well defined symptoms should point the way to early diagnosis.

Leavitt's report (2) of 350 cases of brain tumors, from the records of the Philadel-

phia Hospitals, states that clinically only 23 were recognized in children. He explains, however, that many brain tumors were not diagnosed clinically and believes that the larger proportion in Cushing's series was due to the greater "tumor consciousness" on the part of the examining staff at the Boston Hospital.

Tooth (3) analyzed 500 intracranial new-growth verified either at operation or post-mortem examination at the National Hospital in London, over a period of ten years, and determined that 139, or 27.8 per cent, were in individuals from one to twenty years of age.

A similar condition of affairs exists in malignant growths of the spinal cord. For example, in a collection of 251 tumors of the spinal cord from autopsy records, Schlesinger (4) found 60 tumors, or nearly one-fourth, in children under fifteen. In this series, 33 occurred before the age of nine, and 27 between the ages of nine and fifteen.

Quite in keeping with this is the frequency of neuroblastomas of the suprarenals and tumors about the kidney. The studies of Warner (5), Wollstein (6, 7), Sturtevant and Kelly (8), Kwartin and Twiss (9), Bendixen and Lamb (10) and others, indicate that nearly 20 per cent of all tumors in childhood are renal tumors. It is particularly noticeable that the greatest proportion of these tumors occur in the first five years of life, and are not so common after the fifth year.

Primary carcinoma of the liver is another group not uncommon in children, according to Rosenbusch (11), who collected 32 cases, of which 20, or nearly two-thirds, were in children under five years of age.

Aside from the tumors just mentioned sarcomas of the ovary in the young are not

One young man, with Hodgkin's disease, showed good regression of nodes and a gain in weight. One patient with pseudoleukemia, who early in the course of the work had received, without improvement, a dose of approximately only 8 per cent, was later brought back to receive enough additional treatment to bring the total dose up to 25 per cent. With this dose his improvement has been definite. Another patient with lymphatic leukemia, who received 15 per cent, has improved sufficiently to be able to return to work.

DR G FAILLA (New York City). I can add little to the present discussion, because it is almost entirely a question of the dose which patients can tolerate under these conditions.

As far as the machinery is concerned, I may say that it is very simple, requires little attention, and has given us practically no trouble. We made a large ionization chamber in order to produce a current large enough to operate a Leeds and Northrup recorder. In this way we obtain a graphic record of the intensity of radiation used during a treatment and the intervals during which the machine was shut down. Furthermore the chart enables us to tell at a glance how the machine is functioning at any time, and particularly dur-

ing the night when no technical help is available.

I am very much interested in the experiment, however, on account of its relation to the problem of differential action we have been studying in the laboratory. The prolongation of the time during which the radiation is administered is one of the factors which may influence favorably the relative radiosensitivity of pathologic and normal tissues. That is, the prolonged treatment may make it possible for the normal tissues to receive, without injury, a dose of radiation which at the same time is injurious to the pathologic tissues. It is too early to say whether or not such is the case in this experiment, but the results are encouraging.

DR HEUBLEIN (closing). One of the interesting observations made in this experiment is that, with the administration of amounts of radiation ranging from 5 to 25 per cent of an erythema dose to the entire body, there has been no depression in the number of white cells. The white cell count is known to be a very sensitive index of radiation effect. Nevertheless, definite regression of some tumors has been observed with such small doses as we have administered.

X-ray Tubes at High Voltages.—Prof C C Lauritsen, of the California Institute of Technology, has discussed the working of the 900,000 volt X-ray tube with which it is hoped soon to attempt biological applications. Dr Lauritsen produced the high voltage by means of transformer as in the conventional X-ray tube operation, whereas Dr M A Tuve, of the Carnegie Institution of Washington, uses a form of Tesla coil with which higher voltages are possible. Dr Lauritsen's rays are more intense and dangerous to the worker.

Dr W D Coolidge, in discussing the difficulties encountered in designing X-ray tubes for operation at these high voltages, has said that a great reduction in both space and electrical hazard is possible by operating both the tube and the high voltage source immersed in oil. No portion of the high voltage circuit will be exposed to the air. The glass used for the tube should be free from the elongated bubbles found generally in drawn glass tubing.—*Science Service*

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Aside from the tumors just mentioned, sarcomas of the ovary in the young are not

infrequently encountered Downes (12) reported 26 cases of ovarian tumors in children, aged less than ten years, and of these 16 were malignant tumors On the other hand, the Mayo Clinic reviewed 564 malignant tumors of the ovary operated upon from 1916 to 1926, and found only 5 in young persons less than twenty years of age Doran (14) cites one in a seven-months fetus, and one in an infant twenty-two months old Recently Hunt (15) has described a carcinoma of the ovary in an infant seventeen months old

Quite a number of carcinomas of the stomach and intestines are detailed in the literature Uhlhorn (16) gathered 69 cases of cancer of the rectum in children under fifteen So, too, newgrowths of the internal secretory glands as the thyroid, thymus, pancreas, prostate, etc., are described by Calvin (17), Slesinger (18), Lacquierre and Bouchard (19), and a host of others Sarcomatosis in the skull and chest have been reported by Lattes (20), Peacock (21), and others Parker and Stokes (22), in 1925, published reports of ten intra-ocular sarcomas in children which occurred in their own practice

From this brief outline of the occurrence of neoplasms in the young it is increasingly evident that they are not as rare as one would assume, and the reason that they are not more frequently diagnosed is due, perhaps, to a lack of concentrated effort Referring again to Cushing's series, 213 of which occurred during childhood, it would seem that, if these brain tumors in children were more carefully tabulated, other observers might find similar conditions

As a general survey, then, let us consider briefly the most frequent types of neoplasms in children in order to project and stress the outstanding features and thereby facilitate early recognition It would serve our purpose best to classify the more common types of tumors occurring in children into the following groups

- (1) Cerebro-spinal Tumors
 - (a) The intracranial tumors
 - (b) Those of the spinal cord
- (2) The malignant tumors of the suprarenal and the renal region
- (3) Malignant tumors of the bone
- (4) Miscellaneous group of carcinomas and sarcomas
- (5) The lymphomas, including the blood tumors as a supplementary group

1 CEREBRO-SPINAL TUMORS

(a) The Intracranial Tumors—In this group, the symptoms express themselves in such constant and definite manner that it would appear that early diagnosis ought not to be too difficult. For example, in a child with unexplained vomiting, headache, and unsteadiness of the extremities, without nausea or digestive disturbances, in conjunction with a perceptible enlargement of the head, the clinician should be on guard to examine the eye grounds every week or two, until the presence of a tumor in the brain has either been established or ruled out

The more common types of brain tumors in children are (a) the medulloblastomas and (b) the astrocytomas These neoplasms make up such a large proportion of brain tumors that practically three out of four of all the intracranial newgrowths in childhood fall into this group The medulloblastomas are essentially tumors of pre-adolescence, occurring as a rule in the midcerebellar or fourth ventricular region

The second type, or astrocytoma, is met with nearly twice as often as the medulloblastoma This also arises from the roof of the fourth ventricle, but differs from medulloblastoma in its comparative benignity, insofar as it grows very slowly While the astrocytomas are also tumors of the young, a great many are encountered later in life, due perhaps to their slower rate of growth

Next in importance to the gliomas in the

young are the congenital tumors of the brain. This group is made up chiefly of the adenomas. Generally they interfere seriously with the function of the pituitary body. Lately much interest has been manifested in this group of tumors.

While all of these tumors generally exist from early childhood, in only 20 of the 71 tumors in Cushing's series did the symptoms become recognizable before adolescence.

In 1890 Starr (23) reported a series of 300 brain tumors in children, and it is a matter of much speculation that, in his series, 50 per cent of the lesions were diagnosed as tuberculomas. Cushing, on the other hand, found these tumors very rare, only six cases being met with in his series, and assumes that this difference may be due to a decrease in tuberculosis in general. The infrequency of tuberculomas has been confirmed by other writers. Generally speaking, however, when they do occur the tuberculomas are more malignant than the true neoplasms.

(b) *Tumors of the Spinal Cord*.—In marked contrast to the brain tumors, the symptoms of the spinal tumors are not so clearly defined, even in tumors of the same segmental level. Lumbar puncture will often induce an increase in the sensory symptoms if they are already present, and this phenomenon is of great value as an aid to diagnosis. The lumbar manometric test appears to be of greatest significance, and Stookey (24, 25) is of the opinion that, in half of the cases, diagnosis would have been impossible without this test. He emphatically states that this should be the routine procedure in every spinal cord lesion.

Tumors of the spinal cord in children fall also into two groups: (a) the intra-medullary, and (b) the extra-dural.

Tumors of the intra-medullary group vary greatly in their symptomatology, as well as in their histopathology. Owing to the lack of a definite clinical syndrome,

many of these cases go unrecognized, as the bladder and rectal disturbances occur only late in the disease. The extra-medullary tumors belong either to the sarcoma or the fibrosarcoma type. The average age of the children in the intra-medullary group in Stookey's series was eleven years, while the extra-dural spinal tumors are usually encountered in children averaging three years.

2 MALIGNANT TUMORS OF SUPRARENAL AND RENAL REGION

The suprarenal tumors occurring in children have been recognized perhaps with greater frequency than the intracranial tumors. They occur anywhere from the age of three months up to puberty. In studying the clinical history of these tumors, one is impressed with the similarity of the subjective symptoms in this group of neoplasms.

Robert Hutchinson (26), in 1907, was the first to draw attention to these tumors which he called the "suprarenal sarcomas." The clinical and pathologic features of these cases run almost parallel, in the majority, the first symptom noticed is single or multiple swellings about the bones of the skull. Following, or sometimes preceding this, proptosis of one or both eyes is observed. In most of the children, discoloration of the eyelid on one side was the leading symptom, and in some instances this was the first one to attract attention. An abdominal tumor in one or the other loin was positive on palpation in about half of the children. Anemia also was a striking feature in every case. These tumors generally are highly malignant, and run a very rapid course, the duration in the oldest child being about six months.

A large percentage of these neoplasms occur in the first five years of life, and are relatively infrequent afterwards. From the suggestive symptoms it would seem that early recognition of these tumors ought to promise a better prognosis, providing they

are seen before the appearance of widespread metastases in the skull and other parts of the short bones. In a large majority of cases, the tumor should be recognized and of greatest diagnostic value is the ecchymosis of one eye, generally on the same side as the affected suprarenal. As these growths give rise to involvement of the orbit, Sturtevant and Kelly have made it serve a diagnostic purpose, since unilateral swelling of the orbit, in their opinion, casts definite suspicion of metastases from a suprarenal tumor.

There is another type of suprarenal tumor described by Pepper (27) which is not quite as malignant as the neuroblastoma of Hutchinson. This neoplasm gives rise to rapid and progressive distention of the abdomen, without ascites, though there is jaundice, fever, and enlargement of the liver. Pepper's tumor is made up of highly differentiated cells more closely approaching the mature type, grows more slowly, and is relatively benign, in contrast to the Hutchinson type, which is very malignant.

Wollstein described 18 primary renal neoplasms occurring in children between the ages of four months and six years. Four children with a solid type of tumor survived its surgical removal ten months or more. In other words, the prognosis is not entirely hopeless, though the operative mortality is very high.

3 MALIGNANT TUMORS OF THE BONE

Only a brief discussion of this group of bone tumors is possible at this time. This subject is being studied by a special committee of the American College of Surgeons and others, but no definite report has as yet been issued. It is of interest, however, to point to a collection of 864 bone tumors by Christensen (28), in which the age of the patient was definitely ascertained, and nearly 40 per cent were under twenty. The larger number occurred in the latter half of

the second decade. Of the 376 osteogenic sarcomas, 174, or nearly one-half, occurred before the twentieth year, of the 341 giant-cell tumors, 170, or again one-half, were in persons twenty years old or less. In his series of 84 endothelial myelomas, he found that 47 were in children and that the proportion of male to female was 2 to 1.

According to his observations, 93 per cent of all bone tumors in childhood are of one of three types: (1) Osteogenic sarcomas, 48 per cent, (2) giant-cell type, 24 per cent, (3) endothelial myelomas, 20 per cent.

Multiple myelomas have heretofore been considered a disease of adult life, but in Christensen's series, 39 per cent occurred before the twenty-first year.

4 MISCELLANEOUS GROUP OF CARCINOMAS AND SARCOMAS

Only a cursory consideration can be given to this group. From what has been said before, they arise in any part of the body and require considerable amount of skill for detection. The more important, those of the liver, stomach, intestines, rectum, thyroid, thymus, ovary, etc. have already been referred to in a general way. A diagnosis, while difficult, can be made by elimination.

5 THE LYMPHOMAS, INCLUDING THE BLOOD TUMORS AS A SUPPLEMENTARY GROUP

This group takes in the lymphomas, and, as an accessory group, the leukemias. In the opinion of many authors the analogy between leukemias and malignant neoplasms lies in the one being a tumor of the cellular elements of the blood, while the other is of the cellular elements of the fixed tissue. The leukemias, therefore, are tumors inasmuch as they present the essential features of a malignant neoplasm, i.e., unlimited proliferation, atypical character of the cells, local invasion, and metastases to other organs. The infiltrative growth by leukemic cells into various organs is a well recognized phe-

nomenon. The most common leukemias in childhood are the lymphocytic and myelogenous types, and next the chloromas.

Ramsay (29) collected 100 cases of leukemias in infancy and early childhood, 91 from the literature and 9 from his own practice, in children under eight years of age. The disease was twice as frequent before the fifth year. Here, too, the larger proportion occurred in males, and in 70 per cent the lymphocytic type predominated. He found that the average duration of the lymphocytic leukemias in children was 2 months, and that of the myelocytic type 4 3 months. Clinically, the leukemias in the young are comparable to those in adults, namely, the blood picture, the enlarged spleen, accompanied by respiratory difficulty, paroxysmal cough, with general weakness, etc. The blood picture may exhibit an increase in the white blood cells anywhere from 25,000 to 200,000 or more. Roentgenograms will often disclose a mediastinal mass or metastases elsewhere.

Maciotta (30) recently reported lymphatic leukemias occurring in all five children in a family, and in the four last born of another family of eight children.

Chloroma may be included in this group. The outstanding feature is the characteristic greenish color of the tumors, which appear chiefly in the skull, vertebrae, ribs, sternum, etc. Often the first clinical sign of the disease is the bulging of the orbit, followed by the appearance of tumors over the skull. The tumors of the orbit may simulate metastases from a suprarenal sarcoma, though here the blood picture will establish a differential diagnosis. The blood reveals an increase of the lymphocytic or myelocytic elements, the lymphocytic being the more common. The metastatic tumors are usually made up of the same type of cells as those found in the blood. The lymph glands almost without exception show wide involve-

ment. The bone marrow also shows the conspicuous greenish color.

The progress of the disease is very rapid, and manifests itself usually within the first two decades of life. Ashby and Smith (31) report three cases in boys 2½, 5, and 7 years of age, respectively, all rapidly fatal, which came under their observation in a period of six months at the Middlesex Hospital in London. Rosen and Knott (32) have recently presented two cases, one in a girl of 3 and another in a girl 9 years of age.

Under another heading, as a subgroup, are lymphosarcoma and Hodgkin's disease in childhood. They are generally so well recognized that they need no further emphasis here.

GENERAL DISCUSSION

It seems to me that this subject is of sufficient interest to attract the attention of the clinician and cancer student to the relative frequency of certain well defined tumors in the young. Unfortunately the textbooks and most writers have failed to mention that of all tumors in the brain a considerable proportion occur in the first and second decades. Cushing and his co-workers emphasize that tumors of the brain are far more common than is generally supposed. Cushing states further that tumors in the brain rank in frequency with those of the breast and uterus, or at least run a very close second. Medulloblastomas are met with often enough to be spoken of by some as the "fourth ventricle tumors of childhood." Their importance can be appreciated when we keep in mind that these intracranial tumors in children make up practically 20 per cent of all brain tumors. The symptom-complex of intracranial tumors in children, in contrast to tumors in adults, expresses itself with such remarkable constancy that if one is on the lookout for these tumors, a great many can be diagnosed at the bedside. It is reprehensible, therefore, that in one

case described by Cushing, a child was seen by fourteen different consultants and one and all discounted the fact that the head had increased in size, indicating intracranial pressure. Every type of error was committed in arriving at this obvious diagnosis. To repeat again, periodic vomiting coming on in a child without gastro-intestinal symptoms, and, added to this, increasing muscular weakness, a noticeable increase in the size of the skull, and ocular disturbances should strongly point to an intracranial neoplasm. According to what has been said before, it is highly desirable that these conditions be recognized at a much earlier period of the disease, and there is no good reason why diagnostic skill here should not attain the same high level as obtains with cancer in other organs. The recent studies on radiosensitivity, especially of the embryonal tumors, should be of particular interest. In accordance with our newer concepts that tumors in the young, made up of embryonal or lymphoid or undifferentiated cells, are highly sensitive to gamma radiation, it becomes pertinent to ask why, in this particular group of cases, the radio-active substances have received such scant attention.

Prognosis in the intracranial tumors as elsewhere in the body, depends largely upon an early diagnosis. Operative removal of the gliomas is beset with very great technical difficulties due to their anatomic topography. In the astrocytomas, however, malignancy being less rapid, operative interference is well worth attempting, as there are cases on record which remained symptom-free for six years after the removal of the tumor. Astrocytomas are commonly cystic in children and grow rather slowly. On the other hand, post-operative comfort in cases of medulloblastoma averages only about six months.

The suprarenal tumors also speak a language of their own, and this should simplify the diagnosis in the majority of cases, espe-

cially if the pediatrician or cancer specialist is on the lookout for them.

Unfortunately most of these cases come to operation only when the dissemination of secondary tumors has involved the skeletal system, and the mortality in several of the series reported was 35 per cent from the surgical procedure, and from 70 to 80 per cent from the immediate and ultimate results following operation. On the other hand, if the diagnosis is established early, excision of the tumor has been known to result in freedom from recurrence for a number of years.

Radiotherapy has so far not played much of a rôle in the treatment of those tumors in which operation was impossible on account of extreme anemia or the involvement of large blood vessels or atrophy of the unaffected kidney, and reports are as yet too meager to justify one in forming an opinion of its value.

The effects of gamma radiation in endothelial myeloma and the giant-cell type of bone sarcoma have been pretty well recognized, and deserve a definite place in the therapy of these tumors.

In the leukemias and lymphosarcomas and Hodgkin's disease in children the radio-active substances should effect their widest usefulness, for here we are dealing especially with young and immature cells. My own experience in several cases of Hodgkin's disease and lymphosarcoma in the young convinces me that in these cases, especially, radiation has a definite field of usefulness.

In conclusion, let me point out the importance of these tumors in the young by drawing attention to the statistical studies of Pearl and Bacon (33) upon the incidence of cancer and malignant tumor in the necropsy records of the Johns Hopkins Hospital. Out of 6,670 autopsies, 816 showed some form of malignant tumor, and 6 per

cent of these neoplasms were in persons under 20 years of age

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X-rays to be Generated at 18,000,000 Volts

—The production of X-rays as penetrating as cosmic rays, with voltages of 18,000,000, was forecast to the American Association for the Advancement of Science when a report from Dr F Lange and Dr A Brasch, of the University of Berlin, was read by Dr Alexander Goetz, of the California Institute of Technology.

Working in a small valley between two mountain peaks in northern Italy, a place where thunderstorms occur frequently in summer and early autumn, Dr Lange and Dr Brasch emulated the famous early American scientist, Benjamin Franklin, by snatching electrical energy from the skies. With their gathering system, suspended from heavily insulated wires strung across the valley, they obtained discharges of electricity which sparked 25 feet and measured 18,000,000 volts.

Assured by these experiments on Monte Generoso that Nature would provide the high

tension electrical discharges for their experiments, Dr Lange and Dr Brasch returned to their laboratories at the University of Berlin to construct a new type X-ray tube which would withstand such powerful discharges. They succeeded in building a tube of alternate rings of rubber and metal which has been tested at 3,000,000 volts, continuing for an interval of a millionth of a second. These 3,000,000 volt X-rays are the most powerful yet produced, exceeding any so far produced in America. Electrons are so speeded in this tube that they drill holes an inch deep in a brass plate at the bottom of the tube, each electron boring its own hole.

The new X-ray tube, made of rubber and metal instead of glass, is less than a dozen feet long, despite the high voltage it withstands. It is estimated that an ordinary X-ray tube to withstand such voltages would need to be half a mile long, and therefore could not be constructed.—*Science Service*

RADIATION THERAPY OF CANCER¹

BASIC PRINCIPLES, THEIR APPLICATION AND RESULTS

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GAMMA rays, X-rays, ultra-violet rays, sun rays, and infra-red rays are all derived from the electromagnetic spectrum. Harder X-rays and gamma rays of radium, with which therapy of cancer is chiefly concerned, are placed at the extreme short wave end, the only shorter waves are the more recently discovered cosmic rays. Therapeutically to utilize these rays properly the radiologist must be able to produce, measure, and appreciate the qualitative and quantitative reactions of such wave length groups. To this end a brief review of the action and the more essential physical measurements should be in order.

ACTION

It is generally conceded that the biologic action is dependent on the incident radiation absorbed and the law of Bergonie and Tribondeau, that young growing cells undergoing mitosis are more susceptible to the radiation of X- or gamma rays than adult cells, has been the axiom of modern cancer therapy. Another assumption of lesser importance places the cycle of cell mitosis in human cancer tissue at three-and-a-half-day intervals.

Body tissues are arranged as follows in their order of sensitivity to X- or gamma rays. Lymphatic tissue, leukocytes, testicular and ovarian tissue, basal skin layer, mucous membranes, endothelial lining of vessels, adrenals, liver, kidney, connective tissue, muscles, cartilage, and bone. Tissue of children should be respected in accordance with their age.

Among the systemic effects of radiation may be mentioned decrease of blood pressure, potassium, sodium chloride, cholesterol (1) and fatty acid content of the blood, while there may be increase in the alkali reserve, H^P , calcium content, plasma volume, total plasma proteins, and coagulability of the blood. While many of these facts seem fairly conclusive, still the final action on tissue is yet unknown.

DOSIMETRY

Methods of measurement of these rays may be stated to be either direct or indirect. The instruments most in use for the direct methods are the large galvanometer type ionization chamber of Duane and the small "thimble" electroscope type, of which there are several excellent varieties on the market. Instruments commonly used for indirect measurement are the common spark gap (125 mm spheres), voltmeter, milliammeter, and an accurate timepiece.

One of the essential measurements to define ray quality is that of the kilovolt peak, probably best determined by the standard sphere gap. Such gaps (2) should be accurately set according to temperature and pressure readings by an inside micrometer. A more complicated method is by means of the spectroscope. From this function can be derived the minimum wave length by use of the following formula:

$$\frac{12.354}{K.V. \text{ (Peak)}}$$

The next more useful measurement is that of surface intensity. By this we mean the intensity of the radiation delivered to the surface of the body expressed generally in terms of the biologic erythema, which

¹Read before the Detroit Roentgen Ray and Radium Society, May 7, 1931, at Windsor Ontario and also in part before the Buffalo Radiologic Society, March 9, 1931 at Buffalo, New York.

is ordinarily designated as 100 per cent Intensity 10 cm below the body surface compared to the surface intensity is called the depth dose. It is well known that both surface intensity and depth dose vary in accordance with changes in field size, skin target distance (S T D), peak kilovoltage, and filter thickness. Both surface intensity and depth dose measurements are made by means of a suitable ionoquantimeter of the "thimble" type and a water phantom. The intensity at the surface is measured and compared as defined above with that at 10 cm below the surface in the water phantom. Such measurements are most essential for cross-fire technic.

We must have some measurements to define the quality of the beam used in X-ray therapy. This may be expressed as half layer value, average wave length, or, as is generally done, by means of the effective wave length. Duane has defined the effective wave length as that "wave length of a monochromatic radiation that would produce the same effects (readings of the instrument employed, etc.) that the actual radiation produces." This determination is made with the same instrument used for intensity measurement and requires only the addition of a 4 mm aluminum filter for voltages up to 130 K V and 1 mm copper filter for higher voltages. In this manner is determined the percentage of transmitted radiation intensity compared to the surface intensity from which the effective wave length can be ascertained by means of a curve given by Duane (3). For deep therapy equipment at 200 K V and 0.5 mm copper filter, the effective wave length is 0.16 Å, which, according to Duane, gives more information about the quality of the radiation than can be determined in any other way by a single measurement. More recently Taylor (4), of the Bureau of Standards, has elaborated on these measurements (Fig. 1).

As a result of attempts at standardization, the International Unit, the roentgen, designated as the "r unit," has been proposed.

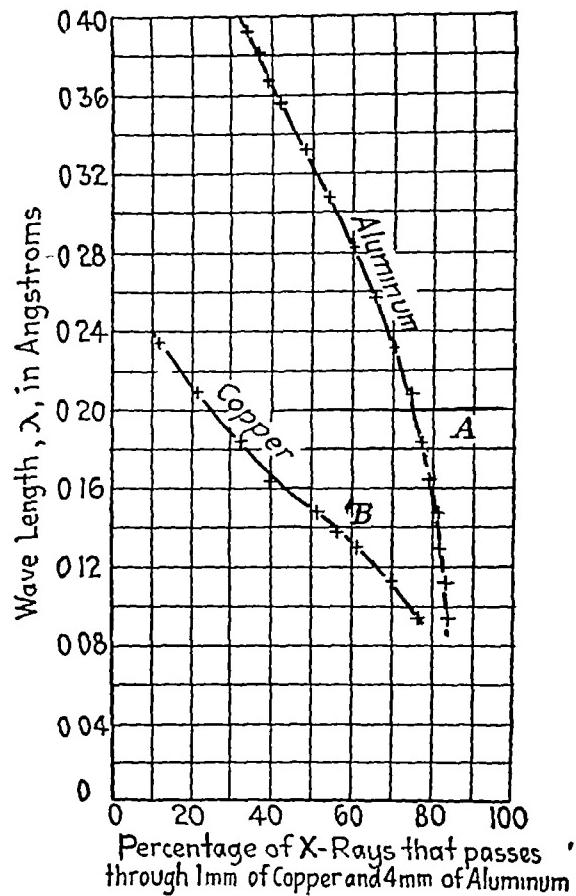


Fig. 1 Duane's curve for determining effective wave length of the X-ray. Such a curve, plus a 1 mm supplementary copper filter in addition to the usual 0.5 mm copper filter and a good ionization chamber, correctly used, is all that is necessary for determination of this quality defining factor of the X-ray beam (3).

and generally adopted. It is defined as "the quantity of radiation which, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in 1 cc of atmospheric air at 0° C and 76 cm mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current." The newer dosimeters, as referred to above, are conveniently calibrated in r. The Cleveland Clinic has given the following physical

dosage, expressed in r, as corresponding well with the biologic erythema, or 100 per cent dose, when secondary radiation is eliminated

| | |
|---------------------------|-----------------|
| Gamma rays | 1,600 r-2,000 r |
| 200 K V (Cu) | 800 r-1,500 r |
| 140 K V (Al) .. - .. | 600 r |
| 90 K V (unfiltered) | 400 r |

dose is that formulated at the Memorial Hospital under the name of "threshold erythema" (7), which represents approximately 75 per cent of the erythema in use by us. It is defined as that dose which will produce a mild reddening of the skin in 80 per cent of individuals tested, and is ap-

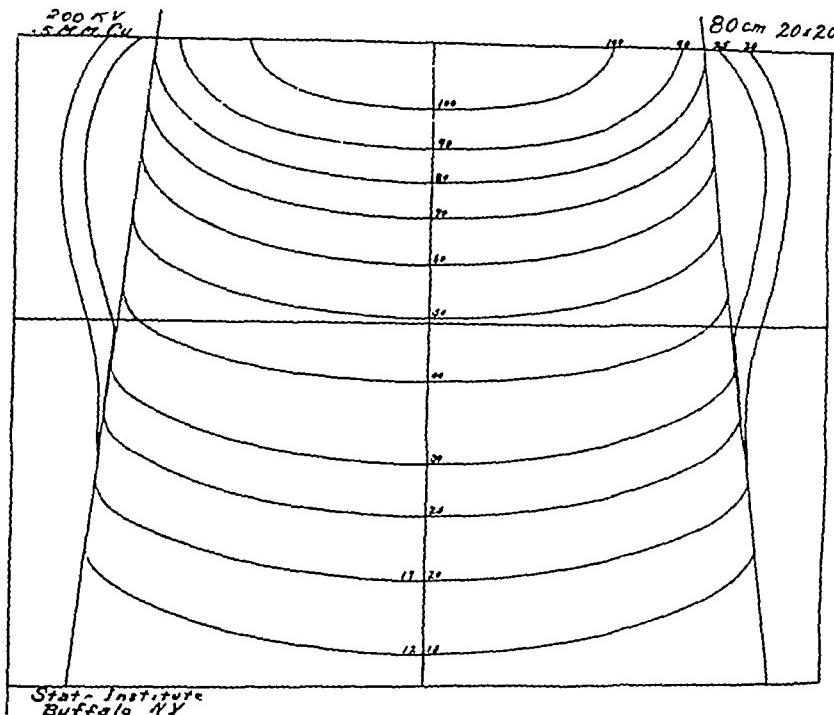


Fig 2 Isodose chart for a field 20 X 20 cm at 80 cm skin target distance (6)

In addition to the above calibrations, which every radiologist should strive to know, there should be in every laboratory a complete set of dosage curves (5), preferably of the Dessauer type, and these should be the basis of all dosage measurement, most essentially of the cross-fire multiple field technic for both radium pack and X-ray (6), in which case bolus bags (one-third china clay and two-thirds flour by weight) should be used (Figs 2-8).

Such physical measurement can now be cautiously checked by determining the biologic erythema by actual test on patients. Probably the best definition of an erythema

proximately 600 r. This reaction is generally most noticeable from about the tenth to the seventeenth day after treatment. The "threshold erythema" is in reality a scientific unit and is not to be mistaken as standard for routine dosage.

In actual technic with either X-ray or radium, most scrutinous care and attention must be paid to use of the proper filters to deliver the ray quality desired. In X-ray therapy 3 mm Al, from 0.5 mm to 3 mm copper, and 1 mm lead are used, but for routine work 0.5 mm copper is probably most efficient and economical. In radium technic a filter which will screen out ap-

proximately 99 per cent of the beta rays is generally adopted. Tables giving comparative filter thicknesses for this purpose are of easy access. Thus 0.6 mm platinum is the equivalent of 1.2 mm lead, or 1.6 mm brass, or 1.3 mm silver, or 1.5 mm monel metal, and will satisfy this requirement (8).

source of radiation, be it X-rays or gamma rays (Fig 5)

For divided dosage technic, it is necessary to have a comprehensive idea of the principle involved. Thus the erythema produced by a single massive dose of 100 per cent at 200 K.V., 0.5 mm copper, effective

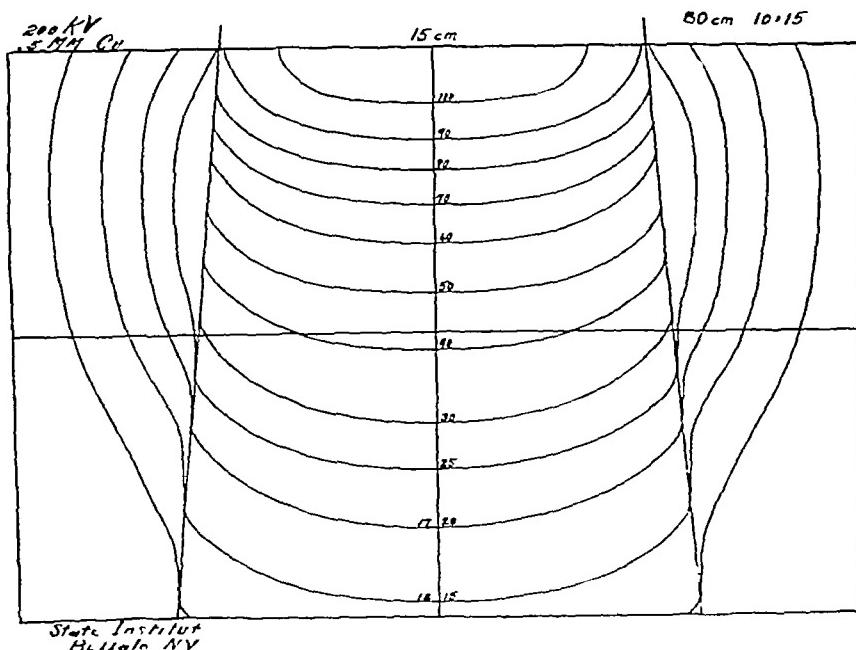


Fig 3 Isodose chart for a field 10×15 cm at 80 cm skin target distance (6)

Attention should be duly given to field size and its relation to time element for the erythema dose. Thus the time factor for an erythema at a sitting for a 400 sq cm field will be less than for smaller fields. Failure to appreciate this commonplace law has often been accompanied by serious consequences. A curve of surface intensity in percentage of the erythema, in which the human erythema is represented as 100 per cent plotted against the field area in square centimeters, is essential and has been given by Bachem (9). In this same connection, it is hardly necessary to call the attention of radiologists to the well-known inverse square law affecting the time element in relation to the skin target distance from the

0.6 Å., has been found by us (10) to correspond to that of 110 per cent over three days, 120 per cent over five days, 130 per cent over eight days, 140 per cent over 10 days, or 150 per cent over 15 days, when treatment was given every second or third day. Pfahler (11) and Hirsch (12) had previously derived such curves and, while they show minor differences, we know from the practical experience of many thousands of treatments that ours works satisfactorily. Such curves are the basis of the "saturation" principle in technic and readily demonstrate why a dose of 100 per cent delivered over a definite time interval of days and not at one sitting, will fall short of producing the biologic erythema.

All radiologists will, therefore, appreciate the benefits of standardization of dosage and calibration of X-ray equipment, for,

the former idea, which is surely worth consideration Nevertheless we still have treatment technic, divided roughly as follows, in

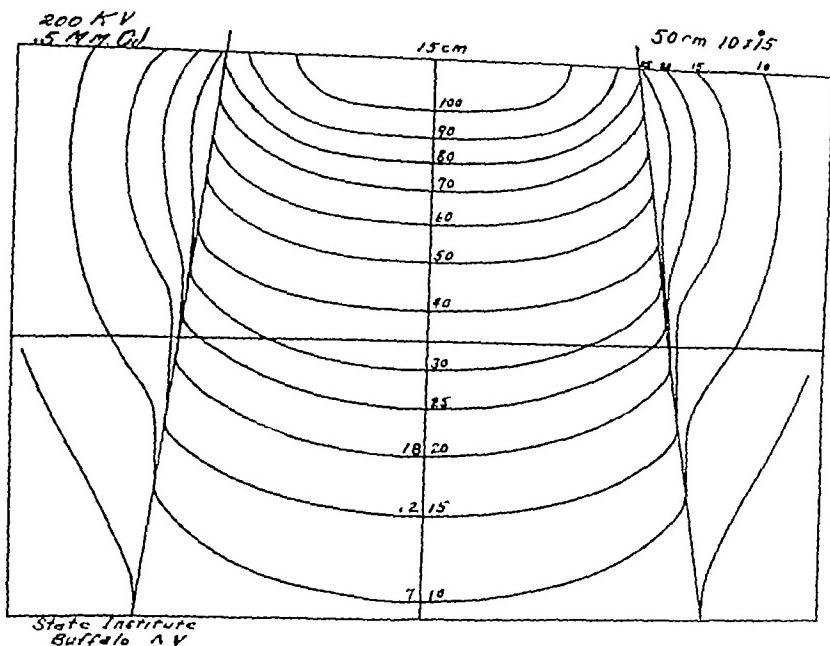


Fig. 4. Isodose chart for a field 10×15 cm at 50 cm skin target distance
(6) 200 KV, 0.5 mm copper filter, 0.16 Å
Data as shown in Tables I to IV were compiled from such isodose curves
and are constantly used in our work at the State Institute

without this, the radiologist would be unable to correlate his work with that of others or to duplicate his own results In this same sense, a close correlation of radium dosage factors expressed in erythemas or percentages thereof is equally essential Here I will refer to previous work from the Institute (5) and a more recent paper by Quimby and Martin (13), from the Memorial Hospital It is only by acquaintance with such erythema equivalents of various X-ray and radium combinations that treatments with these different agents can be intelligently given and danger avoided (Tables I-IV)

The question has often been asked if small amounts of radiation given over a long time are not preferable to large amounts over a short time Regaud and Ewing have been the chief exponents of

which each type seems to have definite indications at times for both radium and X-ray

1 Massive dose technic—unfiltered, Al or Cu

2 Divided dose technic—Al or Cu up to 1 mm (5)

3 Protracted dose technic—3 mm Cu or 1 mm Pb, low milliamperage (14)

4 Saturation dose technic—Al or Cu (11) (Fig. 6)

It is probable that, with the development of 500 KV and 2,000 KV equipment, protracted dose technic with even heavier filtration may come into vogue, or lacking this, then the present protracted dosage technic with 200 KV, 5 ma, through 2 to 3 mm Cu for from two to three hours daily, will increase in popularity Mention should also be made of the noble experiment in

continuous general body radiation being carried on at the Memorial Hospital

Here let me digress to call attention to

should train himself along these lines A basic training in pathology is also most desirable, as much of the effective treatment

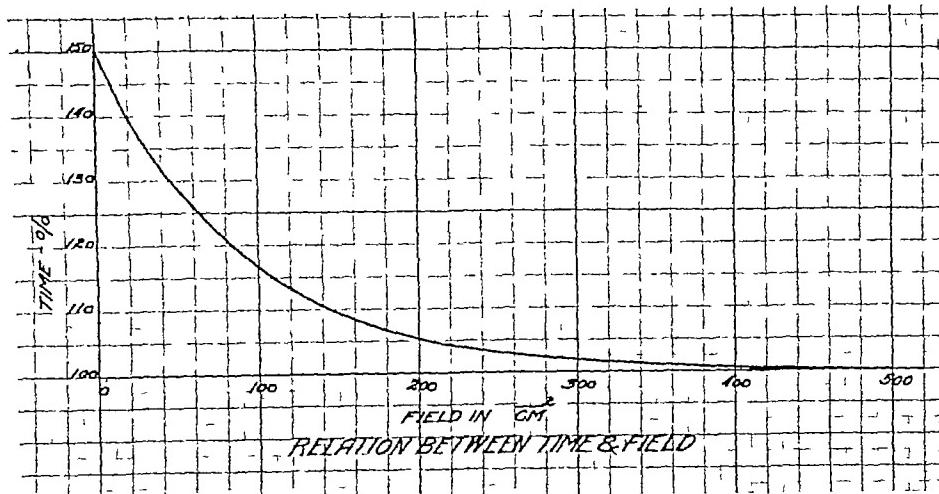


Fig 5 If a 10×15 cm field is used, approximately 10 per cent more time has to be given, as illustrated by the above curve, in order to get the same intensity of skin reaction as when the field size is over 400 square centimeters

proper protection factors The Second International Congress of Radiology (15), July, 1928, recommended a seven-hour day, a five-day week, and a month vacation yearly as the minimum for radiologic workers All treatment rooms should have the walls covered with lead 4 mm thick for voltages up to 200 K V, and thicker for higher voltages Such requirements become self-evident when we stop to reflect on the frequency of reports of ill health, and the development of aplastic anemia and lymphatic leukemia among radium and X-ray workers Some of the earliest effects are manifested by a leukopenia and relative lymphocytosis which should not be ignored

METHODS AND RESULTS

He who would properly treat cancer must recognize that there is no royal method of cure, that the triad on which dependence must be placed is early diagnosis, radiology, and surgery in various combinations Thus one aiming to treat cancer proficiently

given will depend on the actual pathologic histology presented

Time permits of but a cursory review of the methods of treating outstanding types of malignancy and the statistical results will be given as far as possible only on the basis of a five-year arrest or apparent cure of the disease, and from sources from which sufficient material has been available to make the statistics of value Here I would call attention to the thought conveyed by Professor Regaud in his report to the Cancer Sub-committee of the League of Nations in which he referred to the fact that there is as yet no general agreement on the question of correct treatment of cancer and that only by a very thorough organization of work, resulting in the production of irreproachable statistics, can such agreement be eventually reached (16)

For accurate diagnosis I would call attention to the systematic employment of biopsy whenever permissible This practice will also naturally increase the value of statis-

200 K.V

TABLE I—TWO FIELDS OPPOSITE EACH OTHER

0.5 mm Cu

80 cm

STD

20 X 20 cm field

| Diam (cm.) | 100 per cent on field | | 100 per cent on skin | |
|---------------|-----------------------|--------|----------------------|--------|
| | Skin | Center | Field | Center |
| 16 | 122 | 119 | 82 | 98.5 |
| 17 | 120 | 114 | 83.5 | 95 |
| 18 | 118 | 107 | 85 | 91 |
| 19 | 117 | 103 | 86 | 88 |
| 20 | 115 | 98 | 87 | 85 |
| 21 | 114 | 93 | 88 | 82 |
| 22 | 112 | 88 | 89.5 | 79 |
| 23 | 110 | 84 | 91 | 76.5 |
| 24 | 109 | 81 | 92 | 74 |
| 25 | 108 | 77 | 93 | 71.5 |
| 26 | 107 | 74 | 93.5 | 69 |
| 27 | 106 | 70 | 94.5 | 66 |
| 28 | 105 | 66 | 95.5 | 63 |
| 29 | 104 | 63 | 96 | 60.5 |
| 30 | 103 | 60 | 97 | 58 |

TABLE II—200 KV, 0.5 MM, CU FILTER, EFF WAVE LENGTH 0.16 Å, 10 X 15 FIELD
80 cm TSD

| Diam (cm.) | 100 per cent on field | | 100 per cent on skin | |
|---------------|-----------------------|--------|----------------------|--------|
| | Skin | Center | Field | Center |
| 10 | 133 | 146 | 75 | 110 |
| 11 | 130 | 139 | 77 | 107 |
| 12 | 127 | 133 | 79 | 105 |
| 13 | 124 | 125 | 81 | 101 |
| 14 | 122 | 118 | 82 | 97 |
| 15 | 119 | 113 | 84 | 95 |
| 16 | 117 | 106 | 85 | 90 |
| 17 | 116 | 100 | 86 | 86 |
| 18 | 114 | 96 | 88 | 84 |
| 19 | 112 | 90 | 89 | 80 |
| 20 | 111 | 85 | 90 | 77 |
| 21 | 110 | 80 | 91 | 73 |
| 22 | 109 | 77 | 92 | 71 |
| 23 | 108 | 73 | 93 | 68 |
| 24 | 107 | 69 | 94 | 65 |
| 25 | 106 | 65 | 94 | 61 |

tics Broders' classification may be satisfactorily applied in grading the malignancy of many regional groups of cancer and is worthy of consideration from a prognostic viewpoint, especially when evaluated in conjunction with the clinical symptoms and signs.

Basal-cell epithelioma, or rodent ulcer, is one of the most common lesions. It is most often found on the face, it rarely metastasizes, and is best treated by massive doses

Here two or three erythemas of unfiltered X-radiation, depending on the thickness of the primary lesion, or a radium plaque left in place to produce a good reaction, will succeed in permanently healing most cases, unless bone or cartilage is involved. In this event, the lesion is often very refractory. A report of 340 cases from the Institute showed primary healing in 88 per cent and permanent healing in 82 per cent of the cases (17).

TABLE III — TWO FIELDS OPPOSITE EACH OTHER

| 200 K.V | 0.5 mm Cu | | 50 cm | STD | | 10 X 15 cm field |
|--------------|-----------------------|--------|--------|----------------------|--------|------------------|
| Diam (cm) | 100 per cent on field | | Tonsil | 100 per cent on skin | | Tonsil |
| | Skin | Center | | Field | Center | |
| 8 | 135 | 142 | 144 | 74 | 105 | 107 |
| 9 | 131 | 133 | 135 | 76 | 101 | 103 |
| 10 | 127 | 128 | 130 | 79 | 101 | 103 |
| 11 | 123 | 119 | 121 | 81 | 97 | 98 |
| 12 | 121 | 114 | 116 | 83 | 95 | 96 |
| 13 | 118 | 105 | 107 | 85 | 89 | 91 |
| 14 | 116 | 98 | 101 | 86 | 84 | 87 |
| 15 | 114 | 92 | 96 | 88 | 81 | 84.5 |
| 16 | 112 | 87 | 91 | 89 | 77 | 81 |

TABLE IV — LATERAL FACE, JAW OR NECK FIELDS

*Two fields opposite each other*200 K.V., 0.5 mm, Eff. wave length, 0.16 Å, 10 X 15 field
80 cm STD

| 100 per cent on field | | | 100 per cent STD | | | |
|-----------------------|----------------|-------------|---------------------------------|----------|-------------|---------------------------------|
| Cm diam | Surface S.E.D. | Center dose | Dose $\frac{1}{3}$ from surface | On field | Center dose | Dose $\frac{1}{3}$ from surface |
| 10 | 133 | 146 | 150 | 75 | 110 | 113 |
| 11 | 130 | 139 | 143 | 77 | 107 | 110 |
| 12 | 127 | 133 | 136 | 79 | 104 | 107 |
| 13 | 124 | 125 | 127 | 81 | 101 | 103 |
| 14 | 122 | 118 | 123 | 82 | 97 | 102 |
| 15 | 119 | 113 | 119 | 84 | 95 | 101 |

With squamous-cell epithelioma, or epidermoid carcinoma, which is more radio-resistant and tends to metastasize to the regional glands, results are less satisfactory. It occurs most commonly on the skin, lip, penis, clitoris, or vulva and the method of treatment will vary with the location and whether it is infiltrating or papillomatous. In the latter variety, unfiltered X-radiation, radium plaque or tube for 150 mc-hrs or more of gamma radiation, can be used on the lesion. In the infiltrating type, radon seeds of 2 mc each in 0.3 mm gold, or needles of radium with 0.6 mm platinum, should be planted in the lesion, computing on the basis of 2 mc to every 1.5 cm of pathologic tissue. The regional lymph gland areas must be treated with heavy doses of copper-filtered X-radiation or with radium and cobalt-60.

tracted technic. Frequently in epithelioma of the penis or vulva this does not result in satisfactory regression. Then electrocoagulation of the primary lesion is often resorted to, with or without block dissection of the regional glands, if the capsules are intact, and seed implantation in the gland areas, followed by further external radiation. In early penis lesions, amputation by electrothermic methods and heavy external radiation may be employed. In the lesions of both the penis and vulva, the final result is liable to be palliative only. We have seven out of 60 epitheliomas of the penis from the Institute records (18) that are permanently healed for over five years, three after radical operation and radiation, two with partial operation and radiation, and two by unfiltered radiation alone. We

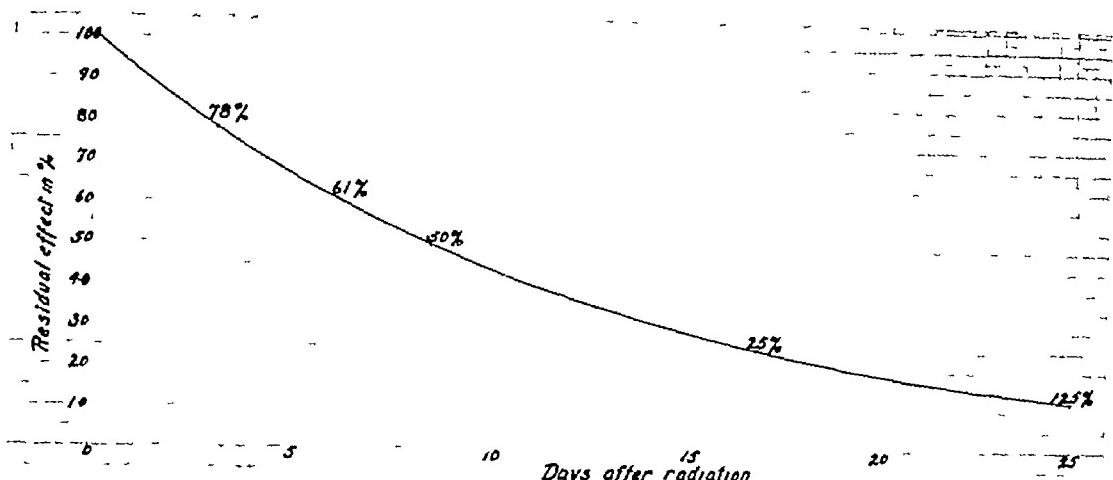


Fig. 6 Residual effect of X-rays at 200 K.V with 0.5 mm Cu filter, 0.16 A from the time of radiation over a period of 25 days (10) is observed from the skin reaction

of epithelioma of the vulva treated by radiation

Epitheliomas of the lip generally occur on the lower lip, metastasize readily to the regional glands, and may be papillomatous or infiltrating in type. They can be successfully treated by needling with radium needles of 0.6 mm platinum or 0.3 mm gold seeds, implanted on the basis of 2 mc for each 1.5 cm of tissue radiating around the periphery and under the lesion. Removal with the radioknife has also been advocated. Papillomatous lesions are often treated by unfiltered X-radiation, delivering two to four erythemas to the closely screened tumor, depending on the thickness of the individual lesion. Another good method consists in using a wax mold in which are incorporated radium tubes of 1 mm platinum, the lesion being thus radiated by a cross-fire method. Regional gland-bearing areas should always be treated with copper-filtered X-radiation or radium pack in full doses. Of lesions without glandular involvement (Group I), 44, or 68 per cent, remained healed for from five to twelve years, 92 per cent of 65 cases in the same group showed primary healing according to our Institute records (19). When the glands are involved (Group II),

in 23 cases only 13 per cent were well more than five years although 61 exhibited primary healing

Epithelioma of the tongue, floor of the mouth, alveolar process, palate, and antrum is more difficult to manage and also tends to metastasize early. Lesions of the lower jaw and floor of the mouth are prognostically less favorable than those of the upper jaw. Here, either gold seeds or platinum needles in the lesion, or a tube of gamma radiation over the primary lesion, with full dosage to the regional glands, seems generally indicated as most expedient.

Lesions of the tongue are treated, as above, with needles or seeds, and X-radiation or pack from without. Such treatments should generally produce an erythema. It is only by approaching such burning doses that therapy can produce results. Regaud has reported primary healing of tongue lesions in 75 per cent and disappearance of glands in a very small percentage of cases. Quick, at the Memorial Hospital, has reported on 140 early cases without gland involvement in which healing was secured in 85 per cent for from two months to three years. More recent experience there will show approximately 45 per cent five-year healings in cases without nodes in the neck.

Such is general radiologic experience Pfahler has reported 55 per cent of early cases without gland involvement well for

end fatally. If they are seen early, intrinsic lesions may be operated on by doing a complete laryngectomy, otherwise attempt

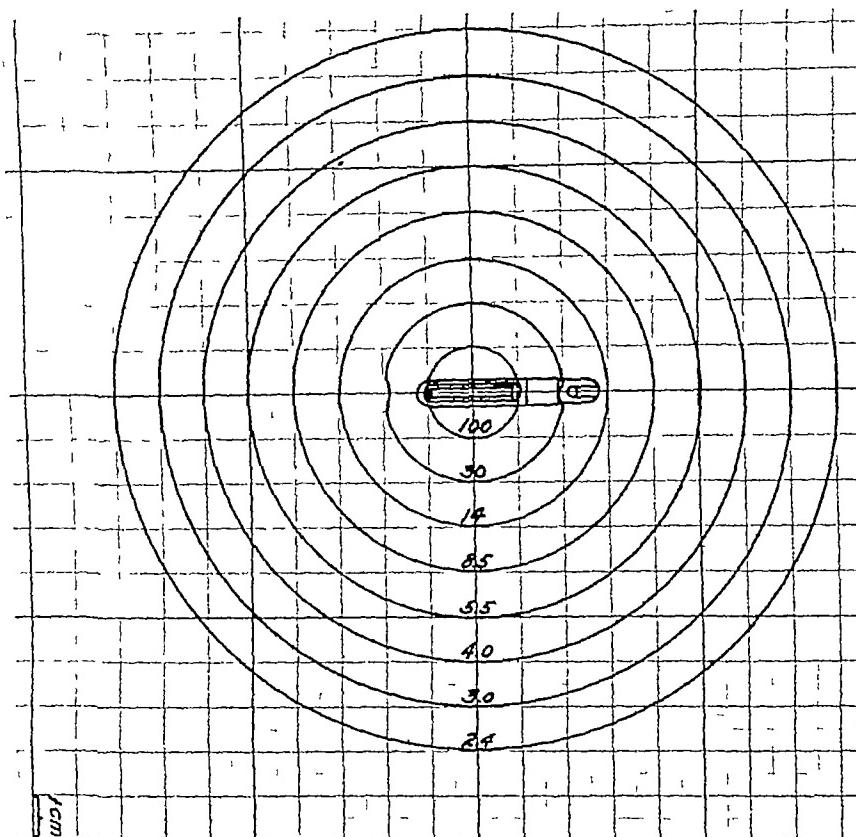


Fig 7 Isodose curve for 100 mg radium tube with 1 mm Pt filtration Active length 21.5 millimeters From paper to be published by M C Reinhard and H L Goltz

from one to fifteen years, and 40 per cent with glands well for from one to eight years

Epithelioma of the pharynx and tonsils is probably best treated by seeding, as above, and external radiation to the gland-bearing areas Quick, from the Memorial Hospital, reports 318 cases of epithelioma of the tonsil, with 14 living and well for five years A later report, to be published by Duffy, gives 38 per cent with no gland metastasis and 20 per cent of all groups clinically cured five years or more

While intrinsic lesions of the larynx are the more refractory, both types generally

should be made at seeding if possible from within or by splitting the thyroid cartilage and directly exposing and seeding the lesion Any method should be followed by external radiation, or this method may be used alone Unless preliminary tracheotomy is performed, small frequent doses making up a heavy total radiation should be given in the attempt to prevent edema of the glottis We have two cases apparently well for several years, one by laryngectomy and the other by external radiation only Regaud has reported very favorable results by external radiation, but no one else seems to be so successful in handling this lesion

Cancer of the stomach or colon, if early, is generally admitted to be best treated surgically. Post-operative treatment by ex-

When copper filtered X-radiation is administered, 80 cm S T D is used to secure the best radiation dose in the tumor and glands

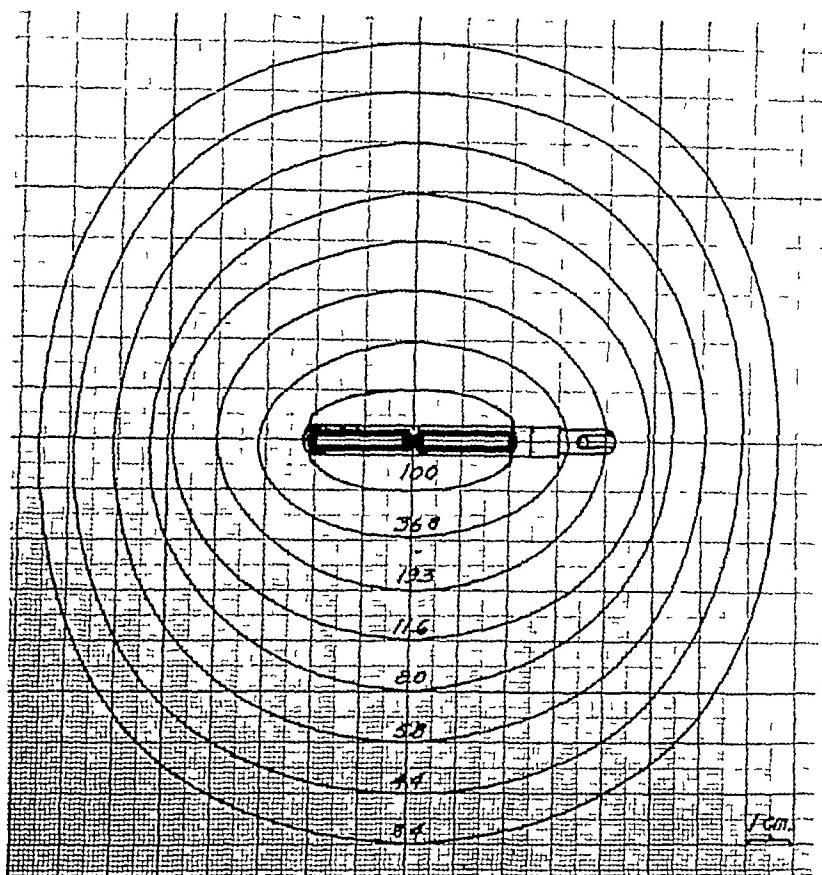


Fig 8 Isodose curve for two tubes in tandem, containing 100 mg radium in each tube with a filtration of 1 mm Pt. Active length 21.5 mm for each tube
From paper to be published by M C Reinhard and H L Goltz

ternal distant radiation, either by X-radiation or radium pack to secure a good tumor dose, should be employed. In most cases treated up to now by exclusive radiation, the results achieved have been only palliative.

Cancer of the esophagus may be dismissed by saying that there is probably no authentic cure by radiation on record. Attempt should always be made at palliation with radium seeds or tubes placed through the esophagoscope, when this is deemed feasible, supplemented by external radiation

Breast cancer should be classified in the following groups, according to Steinthal:

Group I Lesion limited to the breast and not adherent, no glandular involvement.

Group II Same as Group I with the addition of glands in the axilla or ulceration fixed to the muscles.

Group III Same as Group I with or without axillary involvement, but with widespread metastasis into the supraclavicular or mediastinal glands or bone.

Pre-operative and post-operative radiation is the method of choice in the operable

the method of Keynes is fast gaining popularity. Only time can tell the result.

The average length of life of untreated

including the breast, axilla, and supraclavicular region

Evans and Lencutia (21), in reporting

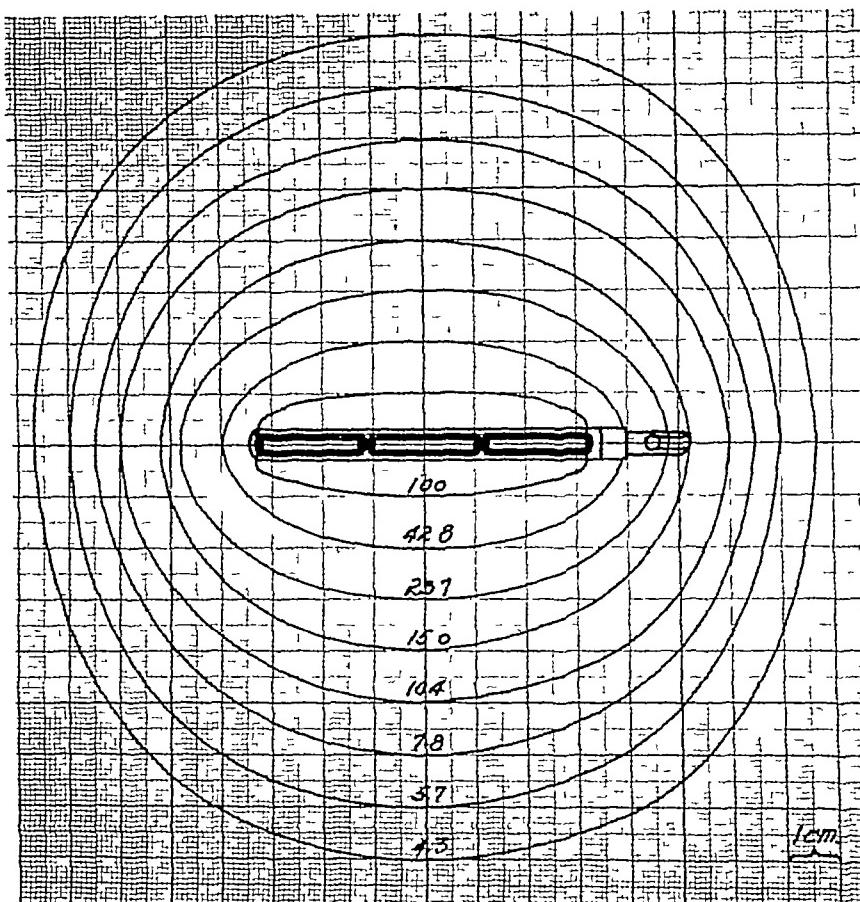


Fig 9 Isodose curve for three tubes in tandem containing 100 mg radium in each tube with a filtration of 1 mm Pt Active length 21.5 millimeters From paper to be published by M C Reinhard and H L Goltz

cases is approximately 32 months. Our treated cases from the Institute (20), based on a study of 489 patients, show five-year arrests as follows:

| | | |
|-------------|-------------|------------|
| Group I | Group II | Group III |
| 65 per cent | 23 per cent | Palliation |

These results were obtained in most cases by the combination of operation and radiation.

In these cases high voltage X-radiation consisted in radiation at from 40 to 50 cm S.T.D. divided over three or four doses giving 120 per cent over five days, 130 per cent over eight days, etc., with a large field

175 cases, give five-year arrests as 70 per cent for Group I and 46 per cent after radical operation, and radiation to the glands in the axilla. In this latter group they believe results to be doubled by radiation. B. J. Lee reporting from Memorial Hospital, shows five-year end-results of 56 per cent in relatively benign lesions, 30 per cent in moderately malignant, and 20 per cent in highly malignant lesions of the breast, with a total of 48 per cent in all groups treated by irradiation, with or without surgery. Schmitz, in reviewing 107 cases, reports 27

Cancer of the stomach or colon, if early, is generally admitted to be best treated surgically Post-operative treatment by ex-

When copper filtered X-radiation is administered, 80 cm S T D is used to secure the best radiation dose in the tumor and glands

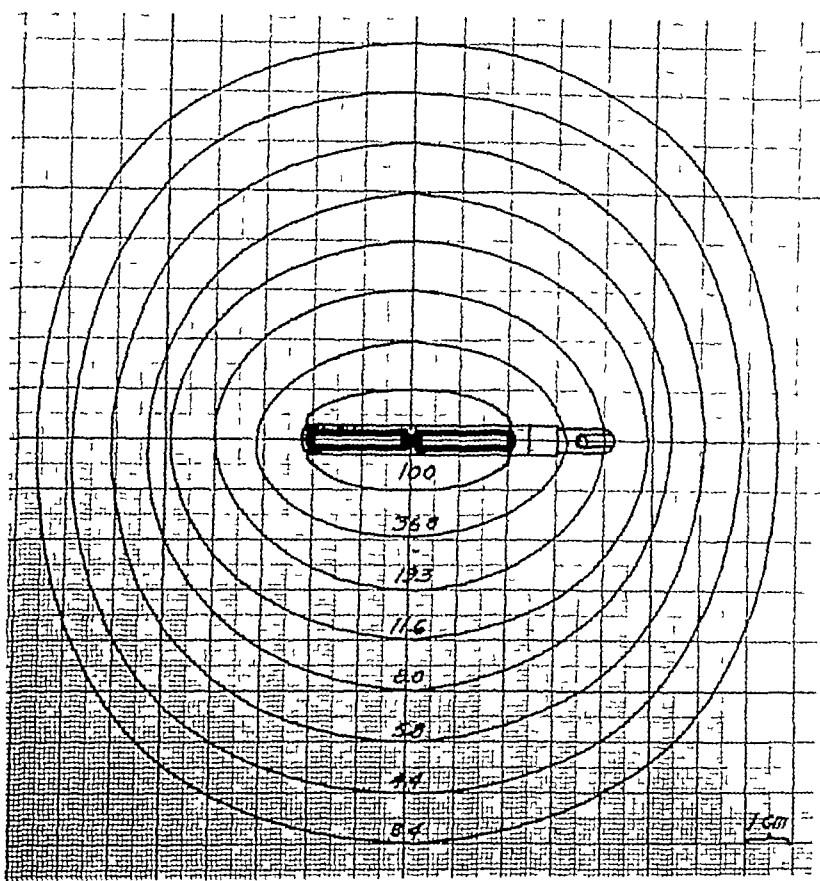


Fig 8 Isodose curve for two tubes in tandem, containing 100 mg radium in each tube with a filtration of 1 mm Pt. Active length 21.5 mm for each tube From paper to be published by M C Reinhard and H L Goltz

ternal distant radiation, either by X-radiation or radium pack to secure a good tumor dose, should be employed In most cases treated up to now by exclusive radiation, the results achieved have been only palliative

Cancer of the esophagus may be dismissed by saying that there is probably no authentic cure by radiation on record Attempt should always be made at palliation with radium seeds or tubes placed through the esophagoscope, when this is deemed possible, supplemented by external radiation from without by the cross-fire method

Breast cancer should be classified in the following groups, according to Steinthal

Group I Lesion limited to the breast and not adherent, no glandular involvement

Group II Same as Group I with the addition of glands in the axilla or ulceration fixed to the muscles

Group III Same as Group I with or without axillary involvement, but with widespread metastasis into the supraclavicular or mediastinal glands or bone

Pre-operative and post-operative radiation is the method of choice in the operable groups but interstitial radiation according to

tures Of course the divided dose technic should be followed Here again results in a curative way fall short of the palliative results achieved The relief of pain in bone metastases of prostatic, as of breast, lesions

operative mortality For purposes of classification these lesions are best divided, according to Schmitz, in four groups

The general method of treatment in most clinics consists in gamma radiation by tubes

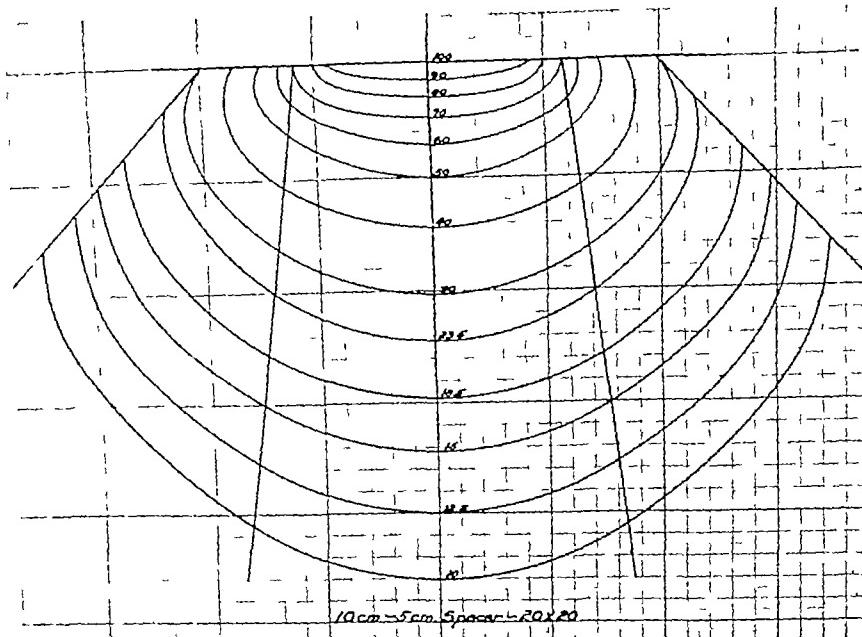


Fig 11 Isodose curve for 4 gm radium pack with 1 mm Pt filtration, 3 mm brass, RSD 15 centimeters Field size 20×20 centimeters Depth dose at 10 cm, approximately 30 per cent. Tables for practical dosage can be made for teleradium therapy as for 200 K.V., 0.5 mm Cu, X-ray (6) From paper to be published by M C Reinhard and H L Goltz

is most gratifying and in some cases seems miraculous, and full doses of high voltage X-radiation to the involved bones should be used While prostatic cancer has given only palliative results to date with radiation, the Registry of Bladder Tumors of the American Urological Association shows 14 per cent of the cases of bladder tumor alive and well five years or more Ferguson of the Memorial Hospital, reports 20 per cent five-year healings in bladder tumors

Epithelioma of the cervix uteri has been one of the triumphs of radiation Many of the largest clinics in the world to-day have discarded radical hysterectomy for this condition in favor of radiation which produces as good results with practically no

in the cervical canal for approximately from 2,000 to 3,000 mc-hrs in addition to needles of platinum or seeds of gold placed around and into the cervix and adjoining broad ligament areas This is supplemented by high voltage cross-fire X-radiation, as in the treatment of rectal and bladder lesions, calculation of combined radium and X-ray dosage being carefully made as in epithelioma of the bladder Here again we prefer an 80 cm STD on account of the better depth dose (49 per cent) This type of treatment and the calculations involved in the cross-fire method have been previously reported (6)

Probably the best statistical review of results achieved in cervical cancer has been

per cent for all groups (22), with 50 per cent in the operable groups, all treated with post-operative X-ray.

Rectal cancer has been conveniently classified surgically as involvement of the

gastro with cancer of the rectum has nearly reached its therapeutic limit, but radium treatment of this disease is as yet very young." Later results with the gold seeding technic promise a material improvement

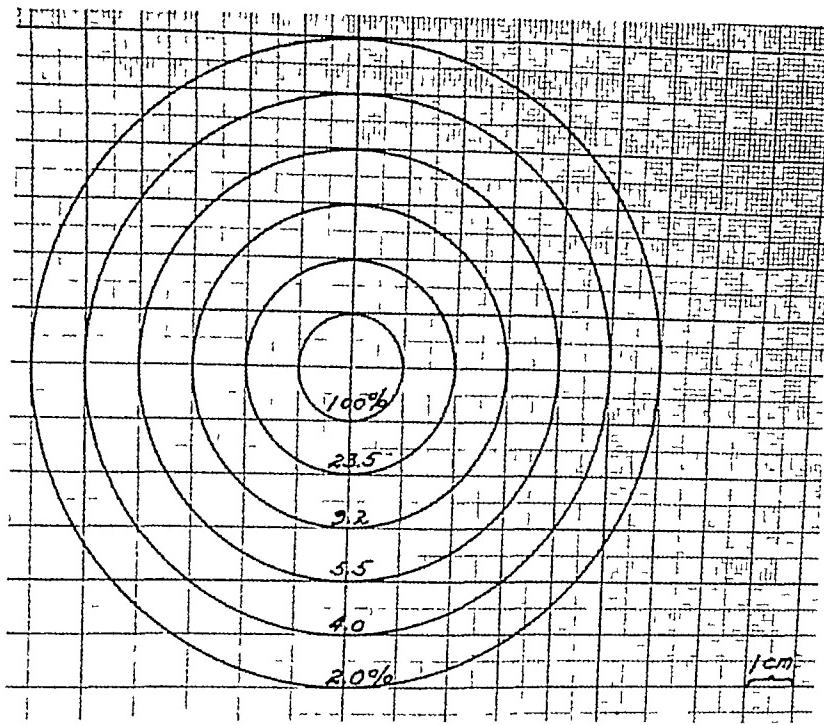


Fig 10 Isodose curve for gold interstitial seeds of 0.3 mm. wall thickness and 3 mm length. *From paper to be published by M C Reinhard and H L Goltz*

anal canal (squamous cell), rectum, and rectosigmoid (the latter two are adenocarcinoma). Under the best radical two-stage operation, D F Jones has secured five-year cures in approximately 50 per cent of the cases, with an operability of 45 per cent.

Our records (23) show 17 per cent of five-year cures in the operable group. These cases were treated with radium tubes with or without glass seeds placed in the local lesion, supplemented by high voltage X-radiation over the pelvis anteriorly and posteriorly, at 80 cm skin target distance. To quote from a recent review of 303 cases of cancer of the rectum seen at the Collis P Huntington Memorial Hospital (24), "Sur-

Furthermore, in such a difficult operation it will always be rare to have the average surgeon achieve the skill of the masters.

Epithelioma of the bladder and adenocarcinoma of the prostate are both best handled by a combination of surgical diathermy, radium implantations, and external radiation of the pelvis by cross-fire method at a long target distance (80 cm S T D) as in rectal and uterine disease. Here the external radiation, if combined with radon seeds or needles, should only supplement the latter. The dosage in all such cases should be cautiously calculated around the bladder, uterus, or rectum on account of injury to the surrounding struc-

cases and has achieved excellent results in early cases treated by removal of the primary tumor and radiation

A recent contribution by Doub on thymoma has been of interest since we have had several such cases which have been classified as lymphosarcoma. In this type of case the response to external radiation, as reported by the aforementioned writer, is often life-saving, transforming a very unfavorable case into one of apparent health in but a few days of divided X-ray or pack therapy.

Up to now our experience with primary carcinoma of the bronchus or lungs has been hopeless. Palliation of considerable extent has, however, been of common occurrence in metastatic lung involvement following a primary tumor in the prostate or thyroid. Here we are accustomed to use 80 cm S T D and an anterior and posterior field centered over the lesion, giving divided dosage to full skin tolerance.

Mixed tumors of the parotid are probably best treated by surgical removal of as much of the tumor as possible or by interstitial radiation when the former seems impractical. This should be followed by external radiation either with high voltage X-ray or the radium pack in divided dosage at preferably a long target distance. We have previously reported on a series of 54 such cases (29) with approximately 10 five-year arrests.

Mixed embryonic tumors of the kidney, hypernephroma and adenocarcinoma of this organ have given only palliation at the best, even after operation. Here divided dosage of high voltage X-ray or radium pack by the cross-fire method is the procedure of preference. Two cases of hypernephroma have lived two and three years respectively and one adenocarcinoma which recurred after operation, remained palliated for almost two years following external radiation (30).

Let us next consider one of the most in-

teresting groups of malignant processes, namely, those known under the generic term of lymphoblastomas, including Hodgkin's disease, or lymphogranuloma malignum, lymphosarcoma often designated as round-cell sarcoma as distinguished from the spindle-cell sarcoma, and the leukemias. This entire group is characterized by a comparatively high degree of radiosensitivity, the leukemic processes, including chloroma, being the most sensitive, lymphosarcoma the next, and Hodgkin's processes probably the least sensitive in this group (31, 32, 33).

The leukemic group of tumor processes is generally recognized by the typical blood picture which commonly accompanies these maladies. Both the chronic myelogenous and the lymphatic group respond nicely to radiation therapy, either X-ray or radium. Here we generally administer 30 to 50 per cent doses over the spleen or enlarged glands (31), the dosage being determined mostly by the blood picture. When the white blood count reaches approximately 20,000 cells per cu mm, radiation is discontinued temporarily until a rising count indicates further treatment. Although we have been unable to cure any of these patients, or probably even to prolong their lives, I am sure we have succeeded in keeping the patients more comfortable, and often self-supporting than could have been achieved by any other means.

There is probably no group of tumors that taxes the ingenuity of trained pathologists more than those of the lymph nodes, especially Hodgkin's and lymphosarcoma. The disconcerting fact remains that occasional sections of such tumors may be submitted to several master pathologists without securing a complete and undivided opinion as to the exact processes involved, thus testifying to the real difficulties in trying to differentiate these processes absolutely.

Here divided dosage of from 70 to 80 per cent of the skin dose delivered to the spleen or enlarged glands will generally

given by Ward and Farrar, of the Woman's Hospital (25). They report 53 per cent of five-year cures in operable Group I and Group II, with 25 per cent of five-year cures in all groups. They summarize similar

In a series of 48 operable cases of adenocarcinoma of the fundus uteri reported from this Institute (28), radiation has given permanent healings in 50 per cent of the cases for five years or more.

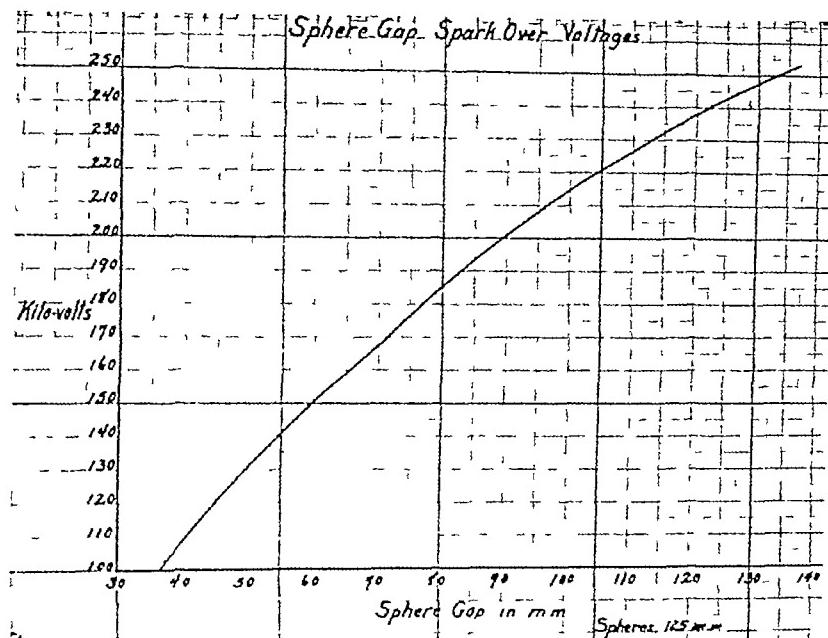


Fig. 12. The correct separation of 125 mm spheres (both insulated) at 741 mm barometric pressure and 25° C temperature is 93 mm for 200 KV peak.

To obtain the proper sphere gap separation for other temperature and pressure conditions, compute correction for temperature as 0.56 mm. for each degree above or below 25° C. If above 25° C, add; if below, subtract correction from 93 millimeters.

Next compute correction for every millimeter of pressure above or below 741 mm by multiplying by 0.21 mm for each millimeter of pressure change. If above 741, subtract; if below, add to the number obtained after correcting for temperature as above.

The result will give the proper sphere gap setting for temperature and pressure conditions desired (2).

operative results in Group I and Group II in over 3,000 cases as 43 per cent, operative mortality as 17 per cent, and operability as 43 per cent.

Our record, reviewing 374 cases (26), shows as follows:

| I | II | III | IV |
|--------|--------|--------|-------|
| 64.28% | 28.57% | 14.47% | 1.44% |

Group I and Group II combined totalled 40 per cent all well five years or more. Schmitz has given equally representative statistics (27).

Round-cell carcinoma of the testis, the seminoma or teratoma testis, is practically never seen by us in the early primary or localized stage. Even after the disease has shown evidence of metastasis, the response of this tumor to radiation is spectacular. Such metastatic masses disappear temporarily and the patient feels perfectly well until later metastasis becomes more widespread and radioresistant to subsequent treatment. More recently Ferguson has reported the presence of Prolan A in the urine of such

doses by a divided technic. In approximately 10 cases so treated, we have succeeded in bringing about a diminution in the size of the tumor, restoration of function, and often the appearance of calcification in the lesion, as demonstrated by the roentgenogram.

Melanosarcoma, or melanoma, has always been classed as a most malignant process. Our records show a five-year arrest and clinical cure in 8 out of 16 cases in which the malady was seen early, before metastasis had occurred (30). In those with dissemination of the process, palliation is all that can be expected at the best. Here radiation therapy, either pack or roentgen rays to full skin tolerance, can be given with small field and closely screened lesion by massive dose technic. The metastatic or gland-bearing areas are best treated by divided dosage methods.

As to the question of repeating the treatment, I would say that it is the consensus of opinion to treat cases with a heavy dose, repeating as seldom as absolutely necessary and not within two or three months in the average case. Too frequent repetition may lead to late tissue reaction three or more months following the last exposure. This is becoming more evident as an example of our enthusiasm to cure, especially as many of the cases of cancer are now living longer than before the advent of radiation. Reports of squamous-cell epithelioma occurring in the scar of a healed breast cancer as the result of X-radiation have come to the writer's attention. The greatest caution is necessary in radiation treatment in general and we should always remember that radiation is not an absolute specific nor does it always cure cancer.

In closing I will quote Dr. Burton T. Simpson (37): "Up to the present time, we have been working with radiation in a purely empiric way, obtaining results without a definite knowledge of its mode of

action. Should it transpire that this agent has a specific action on the cancer cell, the outlook for future results, by using this method of treatment, is very bright."

EXPLANATIONS

Tables I and IV are based on isodose curves (Figs. 2-4) measured at 200 KV with 5 mm copper filter and 0.16 Å effective wave length, and are suitable only under the above conditions.

To use the same, the diameter of the part to be treated is first determined. If two opposite fields are then applied at the extremes of the diameter, the resulting dosage can be calculated from the tables by using the figures given opposite the corresponding diameter of the part (See References 5 and 6). This method, besides possessing equal accuracy, saves time and the more cumbersome application of the isodose curves.

To translate radon dosage into approximate percentage of X-ray erythema at a distance 3 cm from the center of the tubes or a seeded area, *i.e.*, as in the application of uterine tubes or seeds. Tubes (100 gm radium or emanation) to have 1 mm Pt filtration, or its equivalent. Seeds to be made of gold tubing with 3 mm wall thickness and to be approximately 3 mm long.

For intracavitory tubes (one, two, or three in tandem) or gold seeds with filtration as above when the seeds are distributed within the inner half of the radius of the lesion (Quimby and Martin), multiply the total millicurie-hours by the factor 0.03 and the result will be the approximate percentage of the X-ray erythema 3 cm from the center. These calculations are based on isodose curves (See Figures 7 to 10).

APPROXIMATE DOSAGE FOR TELLURIUM PACKS

| (1 mm platinum and 1 mm aluminum) | | |
|-----------------------------------|-------|--|
| 6 cm | S T D | 16,000 to 20,000 mg -hrs |
| 10 cm | S T D | 30,000 to 35,000 mg -hrs |
| 15 cm | S T D | 60,000 to 70,000 mg -hrs divided into daily doses |

cause a disappearance of the process. Such patients are thus kept most comfortable but they are not cured except in a few exceptional cases of lymphosarcoma in which the disease has not spread beyond the primary seat. Thus out of 77 cases of lymphosarcoma hastily reviewed from our files, we have approximately 10 cases who have survived a five-year arrest period or better, without any manifestation of the disease. These cases were mostly those in which the disease was classified as primary or localized on admission.

While I know of no authentic cases of cure of Hodgkin's disease, it might be of interest to mention a patient treated by us who lived comfortably and worked much of the time over a period of 12 years before finally succumbing to the malady. This palliation is generally remarkable, but complete arrest of the process probably never will be secured in the present state of our knowledge.

These cases are best treated with high voltage X-radiation or radium pack, the dosage generally administered being approximately 80 per cent of the erythema (640 r), to the various groups of enlarged glands. We do not recommend the systematic treatment of all lymphatic gland areas when such glands are not enlarged unless it is impossible to see the patient for follow-up treatment at a fairly near future date.

Fibrosarcoma, or spindle-cell sarcoma, on account of its early metastasis by the blood stream, is preferably treated by radiation combined with excision, when it is primary. Here very satisfactory results have been achieved. One case, a boy with a primary spindle-cell sarcoma, was well following radiation from 1917 to 1926, then he developed a recurrence which was surgically removed, followed by radiation of the scar. He has remained well to now with no recurrences. A cursory survey of these cases from the Institute records shows arrests of five years or over in approximately 10 cases

out of 52 in which the lesion remained clinically healed (30).

Bone sarcomas furnish a most interesting and, at the same time, a pessimistic group for treatment. Roentgenograms in this group of tumors are often of more diagnostic significance than poorly chosen or insufficient biopsy material. Bloodgood thinks it is safer to radiate such tumors than to make a biopsy, if there is doubt of the pathologic diagnosis (34). The needle puncture method of securing a biopsy specimen, as recommended by Martin and Ellis, is often successful in distinguishing malignancy from benignity (35). Bloodgood recommends resection if possible for a lesion of the upper extremity, or when the growth is below the lower third of the femur, otherwise he advises a continuance of the radiation treatment. For such a lesion, long skin target distance to full skin tolerance by the divided or protracted technic is the method of choice. We have never produced more than palliation in the osteogenic sarcomas, whereas, in the Ewing sarcoma, palliation both objectively and subjectively is most marked and can be secured by lesser dosage due to the unusual radiosensitivity of this tumor. In fact, the greater radiosensitivity of the Ewing tumor serves to differentiate this endothelial group of bone tumors from the true sarcoma processes. Coley (36) has secured some remarkable results with combinations of surgery, radiation, and the use of Coley's toxin in this group.

We cannot pass without a few brief remarks on the so-called giant-cell sarcomas of bone which Bloodgood has shown to be generally of a benign nature. We have had occasion to treat by radiation many such giant-cell tumors of bone, including the solitary bone cyst, with generally a most gratifying response and lasting result, corroborating the experience of the Memorial Hospital in New York. Here the lesion should be thoroughly radiated with full skin

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New Blood Test for Cancer Developed by German—A new method of detecting cancer in its early stages has been developed by Dr Hans Jacques Fuchs, member of the physiological institute of the Veterinary University of Berlin. Details will be published in a German scientific journal. So far, 2,000 cases have been successfully diagnosed by the new method, the diagnosis being confirmed by operation or dissection. The method also makes possible the determination of the presence or absence of cancer when an infectious disease occurs at the same time. Further, it is claimed that by this method the success of surgical or radiologic treatment of cancer can be controlled.

The new method depends on the digestion of serum from the blood of a suspected cancer patient with fibrin prepared from the blood of a normal person and with fibrin from the blood of a person known to have cancer. The digestion goes on for ten hours at a temperature of 104° Fahrenheit. The protein

is then removed from these samples and the amount of non-protein nitrogen present in each is determined. Depending on the amount of non-protein nitrogen present, it is possible to make a diagnosis as to whether or not the suspected case is one of cancer.

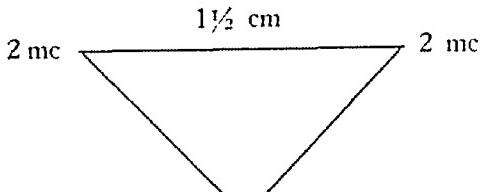
The new method is the result of five years of incessant research work during the course of which Dr Fuchs had to make a number of pieces of special apparatus in order to achieve the necessary exactness in his determinations. The method also marks the first time that a chemical determination of a serological process has been made.

A certain diagnostic test for cancer, such as this is hoped to be, will be particularly valuable because modern methods of treatment by surgery and radiation are chiefly successful only in the early stages of the disease. When cancer attacks the internal organs, it is nearly impossible to detect it in its early stages by present methods of diagnosis.—*Science Service*

1 gm of radium liberates in 1 hour 751 mc emanation or radium destroyed

1 mc radon gives the equivalent of 133.3 mc-hrs of radio-activity before it is completely decayed in its cycle of approximately 30 days

BASIS OF SEED IMPLANTATION, 0.3 MM GOLD



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female, but, after several years of trial, we have emerged more or less disappointed with the results

Let us consider for a moment why this modality has not been all that we had hoped for in the treatment of different forms of pelvic pathology—first, as to the generator itself Many types were put on the market, some good and many bad, the main trouble being a lack of capacity Second, the electrodes were improperly constructed, the usual trouble being a lack of surface, especially in the active electrode Third, improper measurements of the heat supposed to be produced in the tissues—in reality, in the electrode only Fourth, a wrong conception of what was actually needed as to type of heat and its application for the cure of different pathologic lesions

Take, for example, gonorrhreal conditions Different authors claim that 114 degrees Fahrenheit are necessary to kill this type of bacteria The answer to this is contained in the report of Scheffey and Schmidt (1), from the Departments of Gynecology and Physical Therapy in Jefferson Medical College, in which they say "Whatever diathermy accomplishes is due to the increase in circulation brought about by local application of heat, rather than from any heat generated in the diseased tissues themselves and surely not from any destruction of bacteria by heat" Also this quotation from an article by Jeck (2) "After all, it is the heat, however applied, that turns the trick"

The first really scientific attempt to arrive at the temperature of the female pelvis has been carried out by Dr Royston and his co-workers (3) They have designed an interesting instrument and measured the temperature in a very satisfactory manner, and their work is to be highly commended Nevertheless, let me quote from Paragraph 8 in their conclusions "It is impossible to maintain this degree of heat (108 to 115 degrees) for a period of over five to eight minutes, due to the dissipation of heat by

the blood stream" This is not due to faulty technic, but to the modality used, namely, diathermy

What is needed by the average practitioner is a simple, safe, and efficient method that requires no electrical knowledge nor special, complicated technic, and which is applicable to both male and female pelvis

Feeling that much could be gained by exploring the field of heat generated from ordinary sources, and realizing the benefit that we have derived from hot water in the form of baths, douches, irrigations, the hot water bag, etc., the writer decided to investigate from this angle

Hot water applied directly to the mucous surfaces is, after a time, an irritant It is also "messy," yet it produces an ideal, even heat Water confined within a suitable container that is flexible yet separates it from contact with the mucous membrane should be ideal The container must be flexible and dilatable, so that it will conform to any and all irregularities of contour The arrangement must be such that when its bulk is introduced into the vagina or rectum it will be small, yet capable of being increased so that a maximum amount of heating surface may be brought in contact with the pelvic contents Therefore, a perfectly safe heating element must be designed, one which a novice may operate and one which cannot produce a steam burn in the event that the flexible container should break or leak

The diathermy electrodes on the market to-day are all of the rigid variety, and the surface contact is necessarily limited, the greatest amount of electrical contact obtainable being from approximately 10 to 12 square inches Due to the rigidity of the instrument, perfect contact with a prostate, for example, is impossible, while a flexible instrument will mold itself around the organ, thereby bringing the maximum amount of heat in contact with it

The problem of maintaining heat in the

SEVEN THOUSAND ÅNGSTROM UNITS PLUS¹

By RALPH C WALKER, M.D., PORTLAND, OREGON

BACK in the dim and distant past when man first made his appearance on this globe, he had no need for heat to keep himself warm and comfortable, for the earth was steaming and covered with a rank vegetation. Man had not yet learned to cook his food, for he had had no acquaintanceship with fire, and so still lived on herbs and shell fish. Terrific storms raged over the face of the earth, and the electrical discharges from the moisture-laden clouds brought terror to his primitive heart, but no fires resulted from this fascinating display, owing to the great dampness of the vegetation.

Later this condition gradually changed and man was made acquainted with the phenomenon of fire, which he worshipped, for he had grown to believe that it had been created by the gods of lightning, whose language he had partly understood in the terrible bolts. As the temperature of the atmosphere gradually decreased, man timidly approached these sacred fires and discovered that the heat was comforting to his benumbed body. Still later in the process of evolution, we are told that at one time two wild animals engaged in a death struggle accidentally fell into one of these fires and that their bodies were partly consumed. The odor of roasted flesh stirred a something in the innermost part of the cave man, and approaching, he timidly poked with his finger at the half-burned body of one of the animals. His curiosity cost him a burn and he promptly stuck the injured member into his mouth. The results were surprising, for, in addition to having cooled his finger, there lingered a delicious taste. Being more cautious next time, he procured a stick and

continued to experiment, with gratifying gastronomic reactions.

An important moment in history was recorded, for the status of the cave man immediately changed from that of the hunted to that of the hunter. The beasts were pursued and their bodies consigned to the sacred fires until they were roasted, after which they were devoured. In tending these fires men found that their bodies were not only warmed, but that their bruises and contusions were greatly benefited. Thus from antiquity comes our first lesson in the use of "seven thousand Ångstrom units plus."

The technic of conveying this modality to the body varies considerably. Primitive man probably first stood before the fire or slept in the warm ashes or on the heated ground. Later, we read, the early races placed heated stones in a pit dug in the ground, and, by pouring water on them, caused steam to be generated which was confined by means of coverings draped about the body—a forerunner of our modern steam baths.

Personally I can remember that as a child I was awakened at night by the so-called growing pains, at which time my mother would take me on her lap and, opening the door of the big "base burner," would hold me before the glowing coals thus to administer the infra-red rays to my aching limbs, with soothing results. Many of you will recall the warming pans, the jug filled with hot water, the heated flat-iron wrapped with flannel, and other contrivances for producing therapeutic heat.

With the development of high frequency currents and their adaptation for use, we thought that we had an ideal and convenient method of heating at will any portion of the body. Naturally, it should be a wonderful thing for pelvic conditions in both male and

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting at Los Angeles, Dec 1-5, 1930.

The bag was provided with an outlet and shut-off clamp, and hot water was introduced through a rubber tube from an ordinary irrigator, the height of the irrigator determining the amount of dilatation of the rubber bag. The heat was gradually increased by allowing the water to flow for a few moments out of the bag into a refuse pail, the temperature of the water in the irrigator being gradually increased to increase the heat in the bag. The time of treatment was 1 25 hour. Even with this crude instrument the results were very surprising.

I have a photostatic copy of one of their reports on the treatment of these acute and chronic gonorrhreal cases. The list comprises 35 cases, ages from six to 42 years, the average age being 24 years. Of these, 10 were fresh cases. These chronic cases had failed to respond to the usual treatment. The average number of treatments received under the new method was 10, the greatest number of treatments given was 30. By the old method, the greatest number of treatments given was 77, with an average of 28. To quote the report, which is dated Jan 3, 1928, the requirements for discharge are as follows: "No person shall be released from quarantine on account of gonococcus infection until three sets of smears of the urethra and cervix, two single and one double, a total of eight—48 hours elapsing between each set, with no douches or treatment—be taken and submitted to an approved laboratory with the report of ALL smears being free from gonococci."

The report does not state the condition of the pelvic organs, which, to those of us handling private cases, is of the utmost importance. In our practice, the cases reporting for treatment are usually of the chronic type with tubal or prostatic infection. Our custom has been to discharge the patients when they are free from all of their pathology rather than just the gonococcus as

demonstrated by the slide test. Also, not all of our cases are venereal. I can perhaps best illustrate by giving you several histories, in synopsis form.

CASE REPORTS

E F X., female, age 49 years, had previously undergone a subtotal hysterectomy for prolapse, part of one ovary being left. The appendix had been removed and the gall bladder explored and found to be full of calculi, however, it was not removed.

The patient was constipated and had been using laxatives for 15 years. She had a rectocele which she held in place by inserting her fingers into the vagina when her bowels moved. The woman suffered from severe headaches every two weeks which confined her to her bed for two or three days at a time. She had experienced hot flashes for two years preceding the present examination. She was mentally depressed and threatened to commit suicide.

This, my first case, was treated with what I now consider a very crude instrument which produced heat only. Treatments were given tri-weekly from May 29, 1929, to August 22 of that year, when she went to the beach. On her return, the patient was treated irregularly until December 20, receiving a total of 74 applications. After three treatments, the woman reported improvement and no headaches. A slight one occurred about a week later, and a little vertigo two weeks later, which was relieved by her lying down for an hour. On September 6, the patient reported that she had had no headaches, and her bowels were moving naturally twice daily. The rectocele at this time remained in place unless very heavy lifting was done, the hot flashes had disappeared and the mental depression was dissipated. In October, she did house cleaning, reporting for a few treatments then, and again in December, when nine treatments were given for the same trouble. The pa-

- pelvis may be compared to that which the heating engineer has had to meet in a draughty house. We wish to produce temperatures greater than the blood, therefore, our blood stream is acting as a cooling system. The engineer increases the number of square feet of heating surface in his radiators until the required amount of heat is obtained in the house. We must increase the number of square inches in our heating system if we are to obtain a required temperature in the pelvis and to maintain it there. Let me again call your attention to the statement of Dr. Royston and his co-workers to the effect that it was impossible to maintain the high degree of temperature for more than from five to eight minutes, due to the dissipation of heat by the blood stream. If we are to get results from heat, we must be able to keep the temperature steady for such length of time as we find necessary for the pathologic condition under treatment.

After much experimentation the speaker has designed an instrument which meets the requirements. The number of square inches of heating surface is approximately 40 for the average patient. The heater is so constructed that it cannot possibly injure the patient. The temperature of the tissues in the pelvis can be raised to 114 degrees Fahrenheit and kept there indefinitely if desired. It has been found that from 30 minutes to one hour is as long a treatment as is usually necessary. Treatments are repeated daily until a marked improvement is noted, after which tri-weekly applications are sufficient.

During the last few months, experiments have been carried on with another type of instrument having the same fundamental principles but designed to be used externally. This has many advantages, the principal one being that it pre-heats the blood stream so that a higher temperature may be maintained within the pelvis with more comfort to the patient. Experimentally it has been

found possible to raise the temperature from four to ten degrees without the patient being cognizant of the fact.

Massage has long been recognized as one of the outstanding physical assets, whether applied by the human hand, by water as in the shower bath, or by mechanical vibration. Heat and massage have always been linked together, therefore, it was but natural to add this modality to the heater. Needless to say the results have been surprisingly improved, so much so that the heating instrument alone is now seldom used except in the very acute cases. Both the internal and external instruments are fitted with these special forms of vibrators. I say special forms because one cannot use the vigorous type of vibration that is produced by the average vibrator sold.

These vibrators must be very gentle in their action so that sexual excitation may be avoided. Yet, with this mild form of vibration, infected tubes in the female and prostates in the male are induced to drain their contents with surprising ease. I have not found it necessary to carry on the usual prostatic massage so universally used. All authors have warned us of the dangers lurking in too frequent, or vigorous, prostatic massage. Would it not then be well to eliminate this phase of treatment and thereby, perhaps remove one cause of malignant degeneration? With this instrument, which molds itself to the contour of the prostate and produces a mild pressure thereon, the heat and vibration produce drainage without irritation or bruising.

The inroads made by gonorrhreal infection in the pelvis of both male and female have, for many years, held the attention of the medical profession and the public in general. Anything that will assist in combating this disease will have a definite place in our armamentarium.

About two and one-half years ago the Seattle City Hospital used a bag of rubber which was inserted into the female pelvis

The bag was provided with an outlet and shut-off clamp, and hot water was introduced through a rubber tube from an ordinary irrigator, the height of the irrigator determining the amount of dilatation of the rubber bag. The heat was gradually increased by allowing the water to flow for a few moments out of the bag into a refuse pail, the temperature of the water in the irrigator being gradually increased to increase the heat in the bag. The time of treatment was 1 25 hour. Even with this crude instrument the results were very surprising.

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tient has had no treatments since December, 1929, and, upon a recent examination, I found her entirely well. She reports that the rectocele is staying in place and that her bowel movements are normal.

E H Y, female, age 30 years, exhibited an old chronic gonorrhreal infection, involving both tubes. On March 1, 1929, the woman suffered an acute attack and was taken to the hospital. Inasmuch as she was flowing, the attending physician thought that attempted abortion was the cause, and so curetted the uterus. As her temperature rose to 105.5 degrees a blood transfusion was given, as well as numerous saline injections. The patient left the hospital after 10 weeks and spent eight weeks at home, where, although she gained in both weight and strength, the pain was acute in her tubes whenever she stood.

At this time, her surgeon wished to remove the tubes but she refused. She was placed on our treatment July 29, 1929. After the first one, she had a bloody, purulent discharge but her improvement was marked, and she resumed her work which kept her on her feet eight hours daily. In October her surgeon pronounced her well. At this time the tubes could not be palpated and there was no soreness in the pelvis.

H H B, male, age 32 years, had suffered from a gonorrhreal infection four years previous to the present examination. This yielded to treatment after a tempestuous course and there had been no return of symptoms. The patient, who consulted me on account of inability to perform his family duties, said that he had been drinking quite a bit of homemade beer. Examination showed the prostate to be slightly enlarged and tender, but smears made from fluid expressed from the posterior urethra showed non-specific bacteria. After the second treatment, the patient had a discharge, purulent in character, but negative for gonococci. After the tenth treatment the discharge dis-

appeared and he was able to have intercourse successfully. He was discharged after 34 treatments.

A N Z, male, age 62 years, height 5 feet, 7 inches, weight 200 pounds, striped. There was no venereal history. Hypospadias, about four years previous to the present examination, the patient found it necessary to urinate more frequently at night, attributing it to an irritable bladder due to his drinking great quantities of water. The number of urinations gradually increased to seven or eight a night. Two years previous to examination, the patient had had an acute prostatitis, but was catheterized only twice. At the time the residual urine was about seven ounces and he was told that operation was necessary. This was refused. On Oct 14, 1930, the patient suffered another attack and consulted me. I removed 36 ounces of urine from the bladder, administered urinary antiseptic, and catheterized him four times daily. Examination revealed a very large, smooth, hard, and tender prostate. Pelvic treatment was instituted at once. Within a few days the patient began to void a bit of urine. The amount rapidly increased, and the catheterizations were decreased in number as the residual urine lessened. It is very probable that the patient had had residual urine during the four years preceding. Six weeks later, the prostate had decreased very materially in size and was not tender, and the residual urine amounted to between 1.75 and 2 ounces.

The patient was not confined to his bed nor was it necessary to irrigate his bladder. Since beginning the treatment, he has continued to attend to his professional duties, has gained in strength, and now reports that he feels better than he has for several years. What the final outcome will be I cannot at this time say, but most certainly, if there be need for surgical interference, the patient will be found in a much improved physical

condition and so better able to meet the shock of an operation

SUMMARY

1 The use of seven thousand Ångstrom units plus dates back to antiquity, fires started by lightning flashes probably being the first generators to be put to use by mankind

2 The development of high frequency currents marked the modern use of this modality, but results in pelvic pathology have not been all that we had expected

3 Failure has been due to the lack of proper equipment, improper measurements of the heat produced, and a wrong conception of what was actually needed in the type of heat and its application for the cure of different pelvic lesions

4 The development of a dilatable instrument to increase the heating surface in the pelvis and to maintain constant temperature up to 114 degrees Fahrenheit over long periods of time, without danger to the patient, has been a most important step

5 The average physician needs a simple safe, and efficient apparatus, one which re-

quires no electrical knowledge or mastery of complicated technic, and which may be used to treat both male and female pelvis

6 The proper type of vibration, in addition to heat, secured results in a much shorter time than did the thermal instrument alone

7 The development of an external applicator to pre-heat the blood stream enables one to secure higher temperatures more rapidly and without discomfort to the patient

8 The results after three years of experience show that both acute and chronic pelvic inflammatory processes can be made to yield in a much shorter time than by the usual mode of treatment, and, in many cases, surgical interference is unnecessary

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X-rays Relieve Baby's Stomach Obstruction—The method whereby X-ray treatment relieves obstruction of the lower opening of the stomach in newborn infants has been successfully used in 33 cases during the last five years, in only four of which it was unsuccessful

Special diets, drugs, and surgical operation to remove the obstruction have all been found effective

methods of relieving pyloric stenosis in many cases The advantage of the new method which employs X-rays is the saving of time The radiation takes effect within 24 hours if it is effective at all, whereas if medical treatment is tried it may require a week or two to be effective By that time, if it is not effective, the child may be so weakened that he cannot stand an operation, if one is considered necessary—*Science Service*

A CRITIQUE OF THE ROENTGEN SIGNS OF INFANTILE SCURVY

WITH REPORT OF THIRTEEN CASES

By KATSUJI KATO, M.D., CHICAGO

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A STUDY of infantile scurvy at present appears to have lost much of its former interest, first, because its etiology is now firmly established, and, second, because of the fact that the disease is rapidly becoming an almost extinct disorder in civilized countries. Nevertheless, the condition still exists. It is interesting to note that the cases which are presented here occurred in Southern California where "sun-kissed oranges" and other citrus fruits which contain the antiscorbutic vitamin are so abundantly produced.

The literature on infantile scurvy is now so enormous that an attempt to review it would be too tedious. But it is important to remember that the disease was first thought to occur frequently in combination with rickets (10), and was, in fact, thought to be a form of acute rickets (20). It was Barlow (4), however, who gave the first comprehensive account of the disease as an independent clinical entity, basing his observations on 31 cases of infantile scurvy. In 1898 a collective investigation of the disease was undertaken by the American Pediatric Society (2). A very extensive study of the anatomy and pathology of scurvy was made by Hojer (17) who characterized the condition as a disease of actively functioning cells throughout the body. Hess and his associates (14, 15, 16) have published numerous papers on the modern conception of the disease in its various aspects.

As the skeletal system exhibits the most characteristic changes in this disease, valuable contributions have been made chiefly in the field of roentgenologic diagnosis. The earliest work was done by Fraenkel

(9), who described (1906) the zone of hypercalcification at the ends of long bones and called it the "white line." Wimberger (29, 30) called our attention to the circular shadow surrounding the center of ossification in the epiphysis of the long bones, insisting on its specificity in scurvy. He considers this a valuable sign in differentiating scurvy from rickets. Schwartz (26) made an interesting observation of the persistence of this ring inclosing the previously rarefied epiphyseal body as a pale inset in the later epiphyseal structure. This shows a much denser shadow as a result of healing. "The coarse, dense structure of the later bony growth appears in such contrast to the washed-out appearance of the previous epiphysis that the epiphyseal structure appears to have a double contour." He also found the same insets at the carpus and tarsus. Of course, these were only in the epiphyses that had reached ossification, namely, the os capitatum and the os hamatum in the carpus, and the os calcis, the astragalus, and the cuboid in the tarsus.

Pelkan (22), basing his observations on the roentgenograms in human scurvy as well as in experimental scurvy of guinea pigs, emphasized, in the diagnosis of early scurvy, the importance of the ground-glass appearance of the shaft, due to the disappearance of trabeculae. He proposed the term "scurvy line" to take the place of the term "Trummerfeld zone."

The four stages of infantile scurvy were clearly set forth by Bromer (6) who analyzed 56 cases from the standpoint of roentgenologic diagnosis.

1. The latent, or borderline, stage in which the most constant sign is the smooth

transparent, ground-glass appearance of the shaft, the pencil-point thinning of the cortex and the edging of the epiphyseal center

2 The second stage is characterized by the appearance of the zone of decreased density just behind the dense broadened line or zone of temporary calcification at the end of the diaphyseal shadow Furthermore, the first sign of hemorrhage may appear, indicating the weakening of the zone of temporary calcification, some of its substance being pushed out by the slight trauma of the distending force of the hemorrhage

3 The third stage is that of well-developed subperiosteal hemorrhage It is in this stage that epiphyseal separations most frequently occur

4 This is the stage of absorption of hemorrhages with repair of all of the scorbutic lesions The progressive decrease in the breadth and length of the hemorrhages, with evidences of calcification, can be made out at this stage

The most recent contribution along this line was made by McLean and McIntosh (19) who made a valuable *résumé* of the frequency with which the various roentgenologic signs of scurvy occurred in 51 cases with especial emphasis on the process of healing They described multiple epiphyseal separations at vertebral ends of several ribs in one patient, which three weeks afterwards were seen to be undergoing calcification with elevation of the periosteum Although the beading of the costochondral junctions on the anterior chest wall in scurvy had been described adequately by Hess and others, this phenomenon of epiphyseal separation at the vertebral ends of the ribs was, for the first time, described by McLean and McIntosh

The 13 cases which form the basis of the present observations were all seen in the medical wards of the Children's Hospital, Los Angeles These cases are presented not as revealing any new facts about infan-

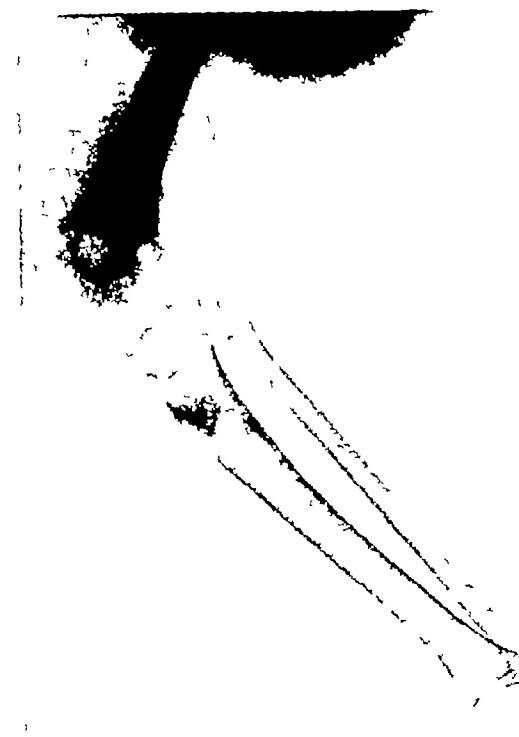


Fig 1 Lateral view of the right leg, Case E P., 11 months old, taken Nov 16, 1927

tile scurvy, but as furnishing the bases on which a critical evaluation of the roentgen signs may be made The essential features of the cases are summarized in Table I

From the summary thus tabulated of the main clinical findings in these cases, it is clear that there is a definite relation of feeding to the development of the disease Practically all are artificially fed infants, either pasteurized cow's milk or some proprietary milk or sugar preparations having been used Condensed milk, Mellin's food, malted milk, and even S M A have been mentioned in the feeding history of these patients Orange juice was not given consistently except in one case in which, however, the dose, one teaspoonful daily, was very inadequate Often mothers state that their scorbutic infants do not take the orange juice well, which apparently constitutes a sufficient excuse for not insisting on

TABLE I—SUMMARY OF THIRTEEN CASES OF INFANTILE SCURVY

| Name | Age, sex | Feeding history | Symptoms and signs | Hospital diagnosis |
|---------|-------------------|---|--|-----------------------------------|
| J O P | 1 year, male | Breast feed first few days, then S M A until 7 months Orange juice not well taken | Pain and swelling of lower extremities, loss in weight, pallor, bulging of right eye, petechial hemorrhage | Scurvy, rickets, secondary anemia |
| X. H. | 14 months, male | Pasteurized cow's milk, no sugar, no orange juice | Sore mouth and swollen gums, lost three or four teeth Cries when moved | Scurvy, rickets |
| D W | 10 months, female | Eagle Brand milk for one month, then formula with orange and prune juice (1 teaspoonful) once a day | Swollen ankles for one week, black and blue spots, nose bleed | Scurvy |
| R A | 1 year, male | Cow's milk formula from birth, 1 lump of butter daily, orange juice only occasionally | Pain in back of the neck and in both legs, bleeding from gums, four plus Wassermann test | Scurvy, rickets |
| B J B | 10 months, female | Mellin's food from birth, no orange juice or cod liver oil given | Pain in back and legs, swelling of legs, gums swollen and bleeding | Scurvy, rickets |
| A C (1) | 8 months, female | Formula with cow's milk first three weeks, then malted milk with Imperial Granum, no vegetables, cereal, orange juice, or cod liver oil given | Stiff leg for four weeks, gums blue and swollen | Scurvy |
| G P | 8 months, male | Cow's milk formula first two weeks, Eskay's food since, but with no orange juice or cod liver oil | Pain on touch | Scurvy |
| E P | 10 months, female | Cow's milk formula from birth, with nothing else | Pain in leg for seven weeks | Acute rickets, scurvy |
| B B | 9 months, female | Bottle-fed since she was three weeks old, no cereal, vegetables, or orange juice, cod liver oil (1 teaspoonful) once daily | Pain in body for three weeks, gums purple | Scurvy, abscess of upper eyelid |
| M J O | 3 months, male | Eagle Brand milk and S M A from birth | Fever and pain in body | Scurvy, acute pyelitis |
| T G | 10 months, male | Cow's milk was given for from 7 to 10 days, then Horlick's malted milk and S M A, occasionally orange juice | Pain in legs, loss of weight, swollen and bleeding gums | Scurvy |
| A C (2) | 5 months, male | Milk and strained oats, no orange juice or cod liver oil | Swelling under both eyes | Scurvy |
| D S | 1 year, male | Certified milk with dextri-maltose orange juice given first six weeks, cod liver oil for one week | Pain in legs for three weeks, red gums | Scurvy, chronic rickets |

its administration. Other vitamin requirements, especially cod liver oil, also seem to have been neglected in many cases. Solid foods have not been given adequately in the majority of the cases. The most remarkable

fault in this series lies in the infrequent use of vegetables. These cases, then, demonstrate very clearly that scurvy in infants is a result of lack in fundamental vitamin requirements, as well as of neglect in the

more liberal use of solid foods, especially the vegetables

Age incidence is also very suggestive. There is a striking agreement as to the time when the disease most frequently occurs

purplish eyelids. Loss of weight is a rather constant symptom, resulting from loss of appetite. Petechial hemorrhages on the skin are sometimes met with. With the hemorrhage along the shaft of long bones,



Fig. 2 (left) Same patient shown in Figure 1 The anteroposterior view of both legs, Dec. 2, 1927

Fig. 3 (right) Same case as shown in Figures 1 and 2, Jan 13, 1928

The majority of these patients are between 8 and 14 months, except two whose age, when scorbutic symptoms first appeared, were three and five months, respectively. From their history and the roentgenograms, they may be regarded as cases of unmistakable scurvy in its latent or early second stage.

As to the symptoms and signs, practically every case gives two typical manifestations, namely, pain on motion, particularly of the legs, and swelling and bleeding from the gums. One patient gives a history of having lost some teeth as a result of the disease. Another gives one of the most remarkable manifestations of hemorrhage, namely, exophthalmos, due to the post-orbital hemorrhage. The right eye of this patient was quite prominent with very edematous and

elevating the periosteum, there is often an appearance of swelling and edema of the extremities. Fever may, or may not, be present. In one patient with fever, there was a complicating acute pyelitis.

The blood picture in scurvy is worthy of attention. Often there is a complaint of pallor which gradually increases in severity with the progress of the disease, usually due to anemia secondary to hemorrhage. In our series, the lowest erythrocyte count was 2,180,000 with 23 per cent hemoglobin. In this patient, the blood smears showed numerous nucleated red blood cells. In many of our patients, there are other signs of anemia, such as achromasia, anisocytosis, and polychromatophilia. Poikilocytosis is practically never found. There seems to be a more or less constant leukocytosis, up to

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| G P | 8 months, male | Cow's milk formula first two weeks, Eskay's food since, but with no orange juice or cod liver oil | Pain on touch | Scurvy |
| E P | 10 months, female | Cow's milk formula from birth, with nothing else | Pain in leg for seven weeks | Acute rickets, scurvy |
| B B | 9 months, female | Bottle-fed since she was three weeks old, no cereal, vegetables, or orange juice, cod liver oil (1 teaspoonful) once daily | Pain in body for three weeks, gums purple. | Scurvy, abscess of upper eyelid |
| M J O | 3 months, male | Eagle Brand milk and S M A from birth | Fever and pain in body | Scurvy, acute pyelitis |
| T G | 10 months, male | Cow's milk was given for from 7 to 10 days, then Horlick's malted milk and S M A, occasionally orange juice | Pain in legs, loss of weight, swollen and bleeding gums | Scurvy |
| A C (2) | 5 months male | Milk and strained oats, no orange juice or cod liver oil | Swelling under both eyes | Scurvy |
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Fig. 5 (upper left) Chest of same patient shown in Figure 4, Oct 14, 1927
Fig. 6 (upper right) Anteroposterior view of both legs, case of J. A. P., April 8, 1929
Fig. 7 (lower left) Lateral view of both legs, same case as shown in Figure 6, April 16, 1929
Fig. 8 (lower right) Chest of same case as shown in Figures 6 and 7, April 8, 1929

ground-glass appearance of the medullary portion and a thinning of the cortex, well visible in all the bones shown on the film. Another point, frequently overlooked at this stage, is a suggestion, or rather a beginning,

of the lateral spur formation. The mere fact that the zone of preparatory calcification is separated from the diaphysis by means of the zone of decreased density makes the lateral ends of this line appear

21,000, with relative increase in polymorphonuclear neutrophils. In one case which showed leukopenia with a decrease in granulocytes, the outcome was fatal, indicating a loss of resistance.

possible to illustrate every case in this series with all the roentgenograms which have been made. Such films as are truly illustrative of special points of clinical value are reproduced in the accompanying figures.

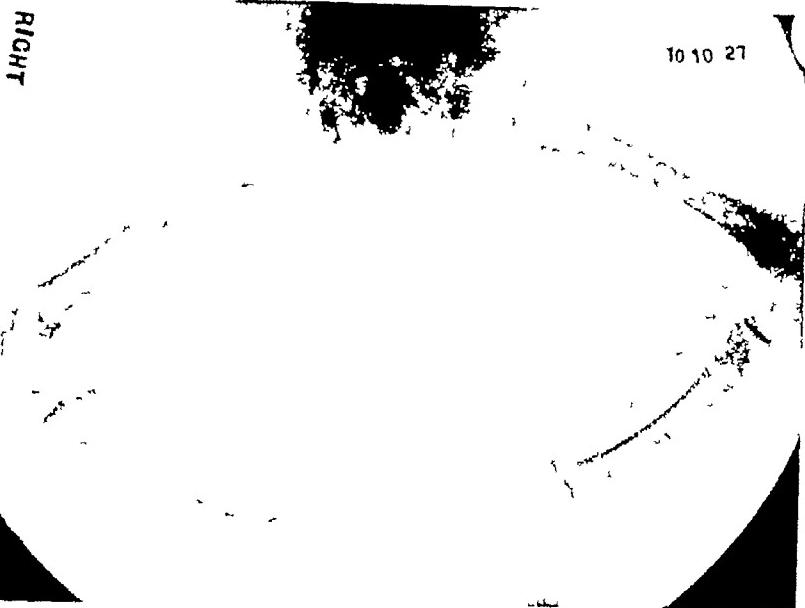


Fig 4 Lateral view of both legs of female patient, B. B., 10 months old, Oct 10, 1927

The treatment routinely adopted in the hospital consisted of the daily administration of fresh orange juice in large quantities together with an adequate dietary régime including the liberal use of solid foods. Up to eight ounces of orange juice were given to these patients each day. The course of the disease was favorable in the majority of cases, as a rule, the acute symptoms subsiding within a few days. Calcification of hemorrhages if any, commenced in about two weeks. Some cases were followed up in the Out-patient Department, and complete healing of the affected bones was proved by roentgenologic examinations many months after the attack of the disease.

In infantile scurvy, the roentgenologic study of the epiphyses of long bones is as interesting as it is valuable, from the standpoint of diagnosis and prognosis. It is im-

The three films from the patient, E. P., 11 months old, are of extreme value in following the course of subperiosteal hemorrhages in the lower extremities. According to the history, the first symptoms of the disease were noticed on Sept 25, 1927. The first roentgenogram (Fig 1), made 50 days afterward (November 16), shows a well-marked line of temporary calcification at the lower end of the femur, and the ends of both tibiae and fibulae. Immediately shaftward to this zone of increased density there is a narrow zone of decreased density, especially noticeable in the lower end of the femur and the upper end of the tibia. Thus, the film in this case shows an unmistakable Trummerfeld zone. Furthermore, there is a generalized atrophy of the shaft, though only moderate in degree, especially noticeable in the body of the fibula, as evidenced by the

TABLE II—BLOOD PICTURE IN INFANTILE SCURVY (13 CASES)

| Case | Erythrocytes | Leukocytes | Hemo-globin (Percent-age) | Differential count | | | | |
|---------|--------------|------------|------------------------------|----------------------|--------------|--------------|------------|----------------|
| | | | | Polymor-phonu-clears | Lympho-cytes | Eosino-phils | Baso-phils | Transi-tionals |
| J O P | 2,180,000 | 15,900 | 23 | 29 | 66 | 1 | 1 | 3 |
| X H | 4,080,000 | 11,450 | 70 | 60 | 40 | — | — | — |
| D W | 3,680,000 | 12,570 | 65 | 68 | 32 | — | — | — |
| R. A | 3,830,000 | 21,600 | 55 | 70 | 30 | — | — | — |
| B J B | 4,560,000 | 10,800 | 60 | 43 | 51 | — | — | 1 |
| A C (1) | 4,120,000 | 13,840 | 70 | 50 | 44 | — | — | 6 |
| E P | 3,660,000 | 20,370 | 60 | 73 | 26 | — | — | — |
| B B | 4,570,000 | 10,020 | 60 | 33 | 65 | 1 | 1 | 1 |
| M J O | 3,010,000 | 14,000 | 43 | 66 | 32 | — | — | 2 |
| T G | 3,140,000 | 11,140 | 40 | 55 | 44 | — | 1 | 1 |
| A C (2) | 4,320,000 | 5,411 | 75 | 12 | 87 | — | — | 1 |
| D S | 4,000,000 | 13,200 | 48 | 40 | 52 | 1 | 1 | 6 |

Note—The blood of patient J O P showed 32 nucleated reds in counting 200 white blood cells. In patient R. A., the blood smear showed hypochromasia and polychromatophilia. In patient M J O, the smear showed anisocytosis, achromia, and polychromatophilia. The smear of patient T G showed slight achromia and anisocytosis. The patient B J B showed very slight achromasia and polychromatophilia.

ing." The fact that such lesions are often found in scurvy is proved by the similar changes seen in the lower ends of the tibia and the fibula in our next patient. Clinically the patient showed typical symptoms of scurvy, namely, pain on motion, particularly in the back and in the legs, with swollen, blue gums. This case is of special interest in that, about two years later, a follow-up roentgenogram was made which revealed a complete healing of bone lesions, but the epiphyses at the upper ends of both tibiae showed the growth arrest line in the form of a rarefied elongated oval inset within the nucleus of ossification.

Very important roentgenologic findings in the chest film of this patient (Fig. 5), taken Oct 14, 1927, were the rounded swellings seen at the costochondral junctions of the ribs. This is the scorbutic beading of the ribs, frequently found in little patients suffering from infantile scurvy, quite analogous to the rachitic rosaries. It is of great interest that the beading of the ribs had almost completely disappeared in the next film, which was taken as a follow-up record 22 months after the previous examination.

As this phenomenon is more frequently

associated with the rachitic process than with scurvy, the two diseases have often been confused. There is still found to-day in the literature peculiar and vague combinations of terms, such as "scurvy rickets," used by some writers as synonymous with "infantile scurvy" (13). The hospital records also indicate the same confusion, as these cases are usually filed under a double classification of "scurvy" and of "rickets."

The next patient, J A P, one year old, presented a remarkable clinical symptom of exophthalmos of the right eye. Both eyelids were purplish-red in color, indicating ecchymosis in the subcutaneous tissue. There was no fever and, therefore, no evidence of this being due to any suppurative condition. The patient was exceedingly pale and anemic, the hemoglobin being 23 per cent (Sahli), with 2,180,000 red blood cells. The roentgenogram of the lower extremities (Fig. 6), made about two months after the onset of symptoms, shows bilateral dislocation of epiphyses on both sides at the lower ends of both femora, with a considerable amount of bone destruction at the metaphyses. There is a slightly noticeable beginning hemorrhage at this point, causing a

particularly prominent. This is suggestive of a spur, even though there is no actual dislocation or displacement of the hypercalcified line.

Another very constant sign at this stage

of the femur. There is no sign of hemorrhage in the lower legs.

The third film (Fig. 3), taken 27 days after the second, is equally spectacular in that the hemorrhages are now being organ-



Fig. 9 Chest and upper extremities, case of R. A., year-old male infant, April 13, 1926

is the so-called Wimberger's sign, which is the edging or rimming of the nucleus of ossification in the epiphysis by a comparatively dense, yet thin, line, its central portion having a typical ground-glass appearance. This gives a peculiar ring-like shape to the oval, or roughly spherical, center of ossification. This sign is found in all epiphyses at the ends of long bones, as well as in the small bones of the wrist and the ankle, as pointed out by Schwartz. It is interesting to note that in this film there is no suggestion of hemorrhage anywhere.

The second film (Fig. 2), taken 18 days after the first, is a very spectacular picture in that the most outstanding phenomenon is the extensive hemorrhage all along the shaft of the femur on both sides. The epiphyses appear to be dislocated, and this dislocation is sometimes called epiphyseal separation. The outer contour of the hemorrhagic mass seems to be continuous with the line of hypercalcification at the lower end

ized and there is an absorption of the hematomas as well as fairly well-marked calcification. The epiphyses still appear separated.

In the next patient, B. B., 10 months old, in whom scurvy had its onset about two months before the first film (Fig. 4) was made, we fail to find all the remarkable roentgen signs of the disease manifested in the previous case. The generalized osteoporosis of the shaft of long bones is evident, with unmistakable Wimberger's sign. The epiphyses of the lower ends of both femora appear to be jammed up against their metaphyses, which is a variety of epiphyseal separation. No hemorrhage was noted in this patient at any time. The Trummerfeld zone is distinct at the upper ends of both tibiae, while the lower ends of both tibiae reveal destructive lesions which closely resemble those found in rickets. The roentgenologist's comment on this film was "Rickets and scurvy, the latter predominat-

having made a correct diagnosis with the aid of roentgenology

THE ROENTGEN SIGNS OF INFANTILE SCURVY

Many references are found in the literature on the roentgen signs of scurvy. Beginning with the work of Fraenkel in 1904, Baetjer, Wimberger, Pelkan, Schwartz, Bromer, and finally McLean and McIntosh, have each contributed very illuminating discussions of these signs in the differential diagnosis of infantile scurvy. After a perusal of these excellent papers, the question naturally arises, "Are these signs truly pathognomonic of infantile scurvy?" A brief discussion of each of these signs may be of interest.

There are at least ten roentgenologic signs found more or less constantly in well-developed cases of infantile scurvy, which may be stated as follows:

1 A finely irregular, broadened, intensely calcified zone of preparatory calcification at the epiphyseal end of long bones, the so-called "white line" of Fraenkel.

2 A small spur at the lateral edge of the epiphysis (Pelkan).

3 A zone of rarefaction immediately back of the zone of preparatory calcification, the "scurvy line" (22), the "framework marrow" (6), or the "Gerustmark" (25).¹

4 A broad, finely irregular edge of dense shadow encircling the nucleus of ossification at the epiphysis, together with rarefaction of the central portion, "Wimberger's sign." This has been shown in the centers of ossification in the carpal and tarsal bones (26).

5 Separation of the epiphysis.

6 A ground-glass transparency of the shaft, with clouding or obliteration of the trabecular structure which is visible in normal bones.

7 A thinning of the cortical shadow, often represented merely by a narrow white line.

8 Subperiosteal hemorrhage and evidence of hemorrhage into the soft parts.

9 Subperiosteal fractures in the ends of the diaphysis.

10 Enlargement and angulation of the costochondral and of the vertebral junctions of the ribs.

The first of these signs, namely, the prominent zone of preparatory calcification, which is very striking in scorbutic bones, is, however, not absolutely characteristic. This line represents in general the results of hypercalcification which may be due to either of two causes. The arrested length growth of long bones may cause a piling up of calcium salts at the place of greatest activity, or it may be the result of a deposit of some other abnormal substances. The majority of cases showing this zone of increased density appear to be due to hypercalcification, but at present evidences are still insufficient to conclude that substances other than calcium may not be responsible for the production of this line.

Recently increasing evidence seems to be accumulating which goes to prove that similarly dense lines are produced unmistakably by such conditions as chronic lead poisoning (Vogt, Caffey, Park, etc.), and after a prolonged administration of phosphorus (28) or cod liver oil containing phosphorus (23). Viosterol, which is now being employed clinically in increasing measure, may give rise to a similar dense shadow at the metaphysis.

Lehmann speaks of "year rings" in connection with celiac disease. The lines of hypercalcification at the ends of long bones, associated with areas of distinct rarefaction in the metaphyses, have been seen on the roentgenogram of a fifteen-month-old child who received an intensive anti-rachitic treatment with phosphorized cod liver oil. A general interest now prevailing in the

¹On account of great confusion and ambiguity connected with the term "Trümmerfeldzone" it appears advisable to drop the term in the discussion of infantile scurvy, as no two authors use it with the same connotation.

line of hypercalcification to be indistinct and to appear as definitely separated. Similar changes are noted at the upper ends of both tibiae, and there is a definite hematoma on the upper end of the left tibia. The lower ends of both tibiae and fibulae also show definite changes. The generalized osteoporosis of all these bones, resulting in loss of trabeculations and thinning of the cortices, and the similar atrophy of the epiphyses with positive Wimberger's sign are most characteristic of the transition from the second to the third stage of the disease. It is also worthy of note that the fibula, particularly on the left, appears to be dislocated and its head separated from that of the tibia, due, evidently to the hemorrhage which is taking place at the metaphysis of the tibia.

It is to be added, furthermore, that this case also shows some lesions, particularly at the lower ends of both tibiae and fibulae, which closely resemble those found in rickets. The presence of these changes can be explained more satisfactorily by the generalized bone changes due to scurvy than by assuming a co-existence of rickets.

The film (Fig. 7), taken after eight days of intensive treatment in the hospital, reveals extensive hemorrhages along the shafts of both femora and both tibiae. This is a remarkable film of a very severe form of infantile scurvy, characteristic of the third stage. An interesting finding on this film is the presence of a well developed Trummerfeld zone at the upper ends of both femora, particularly well seen on the right side. Another film (Fig. 8) from this patient shows typical lateral spurs at the upper ends of both humeri, with a well marked Trummerfeld zone. The lower ends of the radii and ulnae also show typical changes. Generalized osteoporosis is evident, but no hemorrhage is noted. It is also interesting to note on this film the beading of the costochondral junctions of the ribs, quite similar to that found in the previous case. As the

film was made with the patient lying on his back, these swellings are not so clearly outlined as in the other case, but they are sufficiently clear for our recognition.

In the next patient, R. A., one year old, the film (Fig. 9), taken about two months after the first symptoms of scurvy were noted, shows extensive hemorrhages on both humeri, more marked on the right. The hemorrhage appears to be undergoing early calcification, which is the beginning of the fourth stage of infantile scurvy. The beading of the ribs is also receding, and the radius and ulna show typical changes at their distal ends. Generalized atrophy of the body of long bones and thinning of the cortex are also evident on this film.

The present series of cases illustrates fairly well the more important roentgen signs of infantile scurvy which have been accepted as pathognomonic of the disease. On the whole, the disease can be readily diagnosed without confusion when the typical clinical signs are present. This corresponds to the second stage from the standpoint of roentgenology. During the first period, in which the clinical signs are so indefinite that a correct diagnosis is impossible, roentgenology comes to the aid in establishing the diagnosis.

Pelkan is able to diagnose latent scurvy by the roentgenologic triad, consisting of (1) the broadened epiphysis (2) the dense shadow around the center of ossification of the epiphysis, and (3) the absence of trabeculations in the shaft. This is an important contribution to pediatrics as well as to roentgenology, for it is a common experience to see cases diagnosed as nutritional disturbance, in which the usual symptoms are pallor, loss of appetite, and failure to gain weight, which, in fact may be latent or borderline cases of infantile scurvy. The fact that automatically high-vitamin diet is prescribed to these patients, with favorable results, does not excuse pediatricians for not

sign, although attention was first called to it by Reyher, in 1912, and by Gott, in 1919. It was Wimberger, however, who insisted that this sign was specific in scurvy. But it has since been pointed out by several authors that this sign is by no means limited to scurvy, it may be found in such conditions as rickets, lead and phosphorus poisoning, as well as in some other forms of metabolic disturbances. Hence, it is impossible to regard this as an absolute sign in the diagnosis of scurvy. In this connection, it is also interesting to note the persistence of this rarefied area in the epiphyseal center of ossification long after recovery from the disease has taken place. This is well demonstrated in one of our patients, a roentgenogram of whom, taken 22 months after the first was made, shows a light circular area in the very core of the lower epiphyses of both femora and the upper epiphyses of both tibiae. It is to be added that McLean and McIntosh observed similar "scars" in a patient with acute lymphatic leukemia as well as in a patient with anemia of the von Jaksch type.

"Separation of the epiphysis" has been regarded by many as a term not strictly accurate in the description of the actual pathology which takes place at the ends of long bones in scurvy. It was Wimberger who proposed to substitute the term "separation of the metaphysis," for the line of cleavage is not through the epiphysis but through the metaphysis, the displaced epiphysis carrying with it the zone of preparatory calcification. Moreover, it has been particularly emphasized by McLean and McIntosh that this separation of epiphysis should include not only the cases in which the epiphyseal center is displaced laterally or anteroposteriorly, causing a distortion of alignment with the main axis of the shaft, but also those in which the dislocation takes place toward or away from the end of the bone even though there is no

actual distortion of alignment. In lateral displacement, we have the formation of lateral spurs, but in longitudinal dislocation, the abnormality is found in an undue widening of the zone of framework marrow or of rarefaction, because of the pull which is exerted by the centrifugal separation. Or it may appear as a jamming-up of the metaphysis with a narrowing, or at times almost an annihilation, of the zone of rarefaction due to the centripetal dislocation of the epiphyseal end. This phenomenon, which is very characteristic, may be regarded as one of the more reliable roentgen signs of scurvy. However, it must be remembered that, in congenital syphilis and osteogenesis imperfecta, such a separation may also take place. The distinguishing feature consists in the position of the line of preparatory calcification with reference to the epiphysis.

Ground-glass appearance of the shaft of long bones has been pointed out, particularly by Pelkan and Bromer, as being frequently found in scurvy. The latter considers this one of the roentgen signs of scurvy in its latent stage, when there are no clinical symptoms. With perfect radiation technic, the phenomenon is found to be due to the loss of trabeculation, caused by the atrophy of the spongiosa. This is very frequently found in scurvy, as our figures indicate, but McLean and McIntosh state that they were able to find this phenomenon in only one-fifth of their cases. That this is not specific for scurvy is shown by the fact that the similar appearance of the medulla of long bones is found in many other conditions, such as rickets, paralyses of many causes, and certain cases of chronic intoxication. Therefore, the emphasis placed on this phenomenon as a distinguishing feature of scurvy, in contrast with that of coarse trabeculation sometimes found in rickets, is not tenable.

The same applies to the thinning of the cortex, which is also regarded by some as

study of various conditions under which this zone may be produced will undoubtedly reveal many other factors in addition to hypercalcification. Thus, we are led to believe that this line is not a sign peculiar to scurvy. The so-called transverse lines described in detail by Eliot, Souther, and Park (8) have no relation to this line, but they are other examples of similar shadows produced under apparently normal conditions.

As to spur formation at this zone of increased density in moderately severe stages of scurvy, it is generally agreed that this may also be present in other conditions, especially rickets. The spur is said to occur in scurvy under three different conditions (1) in association with lateral separation of the epiphysis, the line of cleavage being in the zone of rarefaction, (2) as an early sign of organization and calcification of a subperiosteal hemorrhage, and (3) more rarely without any demonstrable epiphyseal separation or subperiosteal hemorrhage. In rickets, a spur may be seen on a roentgenogram, merely as a matter of contrast between the area of preparatory calcification and the swollen cartilaginous tissues. The distinguishing feature is said to consist in the fact that the lateral spur of scurvy is always at the right angle to the longitudinal shaft of the bone, while in rickets the direction of the projection is often in the direction of the joint. This, however, is not always the case, especially in view of the fact that, in scurvy, the spur is not seen as a solid and uniform projection but may assume variable forms according to the degree of hypercalcification as well as the angle from which the roentgen ray is cast. McLean and McIntosh apparently appreciate this difficulty when they remark, "Consequently the most that can be said in interpreting such a film is that there is some extension outward from the expected margin of the zone of preparatory calcification, the nature of which cannot be more precisely defined."

By far the most important roentgen sign of infantile scurvy is the zone of rarefaction, found just behind the zone of preparatory calcification at the end of the diaphysis. This has been called the scurvy line by Pelkan and the zone of framework marrow (Gerustmark) by Bromer and others. It is represented on the roentgenogram as an area of varying width immediately adjacent to the line of hypercalcification. This zone is apparently produced by a process of increased destruction of trabeculae, or, rather, a failure of the osteogenetic process. It is believed by some that the normally calcified trabeculae are replaced by the fibrous marrow in this region; this process is thought to be peculiar to scurvy. There is, however, one other condition in which this area of rarefaction is frequently present, namely, congenital syphilis. The differentiating points between these two conditions have been discussed by many authors. It must be emphasized here that, when the punched-out, rarefied areas in congenital syphilis happen to be grouped in a row just behind the line of hypercalcification, in appearance they may simulate very closely the scurvy lines. It must be admitted, however, that the presence of this scurvy line is one of the most reliable signs of infantile scurvy on a roentgenogram. Congenital syphilis is usually seen in much younger infants with clear-cut history and other signs which aid in unquestionable diagnosis. These points have been adequately discussed by Alexander and Fraenkel Hartman and Friedman report true scurvy in a seven-year-old child in whom the "Trummerfeldzone" and "Gerustmarkzone" were both lacking.

The dense edging of the periphery of the epiphyseal center of ossification and the rarefaction of its center are analogous in pathogenesis to the increased density of the metaphysis, with its concomitant area of rarefaction immediately shaftward at the end of the long bones. This phenomenon is known in the literature as Wimberger's

ued use of such terms as the "Trummerfeldzone" and "Wimberger's sign" as diagnostic of infantile scurvy leads to confusion. Pelkan's triad in the diagnosis of latent scurvy is a very valuable adjunct, but it is not absolutely characteristic. Beading of the ribs is common both to infantile scurvy and rickets. Separation of epiphyses is most frequently found in infantile scurvy, but it may also be found in other conditions. The white line of Fraenkel is the least characteristic of scurvy, for it is merely a phenomenon of hypercalcification at the end of a long bone, which is seen in many diverse pathologic conditions.

The one sign which is absolutely unique in infantile scurvy is that of subperiosteal hemorrhage during the third stage of the disease. This can be only inferred clinically upon examination of the limbs in the light of a suggestive history, but the final diagnosis must rest on roentgenology.

A conclusion such as this is not to be interpreted to mean an attempt to minimize the diagnostic value of roentgenology, but rather to emphasize the necessity of broadening the experience of both clinicians and roentgenologists in proper evaluation and interpretation of the roentgen signs of infantile scurvy.

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being specific for scurvy during the early stage. But this also is not constant. Its presence alone can never be interpreted as diagnostic for scurvy, as any other condition which causes bone atrophy is likely to produce a similar phenomenon.

Subperiosteal hemorrhage is very frequently found in a severe, acute form of scurvy. It usually seems to be preceded by epiphyseal separation, as it appears to begin at the point of separation, gradually burrowing beneath the periosteum. Due to the disease process, the latter is greatly weakened. The hemorrhage, which may be so extensive as to cover the entire length of the bone involved, is clearly demonstrated in our cases. When present, periosteal hemorrhage is so characteristic that it may be regarded as one of the most reliable roentgen signs of scurvy during its third stage. As healing takes place, the hematoma gradually becomes organized and calcification sets in, with final absorption. With subperiosteal hemorrhage, there may be hemorrhage into the soft parts, but this is of rare occurrence and, for practical purposes, it may be disregarded as a sign of scurvy.

Subperiosteal fractures have been observed by McLean and McIntosh. These occur in the spongy bone at the end of the diaphysis and are usually without a definite line of cleavage, but show a collapse or buckling of the trabecular structure at that point. Fractures, however, are not frequent and constant and, therefore, cannot be regarded as specific for scurvy. When they occur, the condition must be clearly differentiated from rickets, osteogenesis imperfecta, congenital syphilis, and other conditions in which such fractures are also frequently seen.

There is one other roentgen sign of scurvy, often overlooked by some observers and frequently confused by others, namely, the beading of costochondral junctions of the

ribs. McLean and McIntosh fail to mention this sign, although they briefly mention epiphyseal separation, clearly visible as lateral displacement of the zone of preparatory calcification of the diaphysis, at the vertebral ends of several of the ribs. This is a very interesting point, and has received little attention from roentgenologists. The most characteristic changes are found, however, at the costochondral junctions of the ribs anteriorly. During the second stage of the disease, we frequently find a row of swellings, either rounded or angular, along both sides of the sternum. This, called scorbutic beading of the ribs, is quite analogous to rachitic rosaries. Barlow himself states, "The sternum, with adjacent costal cartilages and a small portion of the contiguous ribs, appear as though they had been fractured by a blow from the front and had been forced backward." Hess points out that this beading has been frequently regarded as caused by rickets, hence confusion has arisen in many cases, resulting in an erroneous diagnosis of co-existence of rickets and scurvy. Beading, however, is quite characteristic of scurvy as well as of rickets, although in scurvy it is caused by epiphyseal separation. Thus the beading may be rounded, smooth, knobby in character, or it "may have an angular feel on palpation, the junction taking on a step-like form, as if the abutting ends of the cartilage and the bone were of unequal size and not well fitted to each other." This phenomenon is well illustrated in our Figure 9, in which the sternal ends of the ribs are seen to be enlarged, with characteristic zones of preparatory calcification.

CONCLUSIONS

If the above interpretation of the various time-honored roentgen signs of infantile scurvy is at all correct, there is but one conclusion to draw. The majority of these signs are not pathognomonic. The contin-

ued use of such terms as the "Trümmerfeldzone" and "Wimberger's sign" as diagnostic of infantile scurvy leads to confusion. Pelkan's triad in the diagnosis of latent scurvy is a very valuable adjunct, but it is not absolutely characteristic. Beading of the ribs is common both to infantile scurvy and rickets. Separation of epiphyses is most frequently found in infantile scurvy, but it may also be found in other conditions. The white line of Fraenkel is the least characteristic of scurvy, for it is merely a phenomenon of hypercalcification at the end of a long bone, which is seen in many diverse pathologic conditions.

The one sign which is absolutely unique in infantile scurvy is that of subperiosteal hemorrhage during the third stage of the disease. This can be only inferred clinically, upon examination of the limbs in the light of a suggestive history, but the final diagnosis must rest on roentgenology.

A conclusion such as this is not to be interpreted to mean an attempt to minimize the diagnostic value of roentgenology, but rather to emphasize the necessity of broadening the experience of both clinicians and roentgenologists in proper evaluation and interpretation of the roentgen signs of infantile scurvy.

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U S X-ray Standard Lessens Danger of Burns—The danger of burns during X-ray treatments has been greatly lessened, according to Dr Lauriston Taylor, of the U S Bureau of Standards, by the completion and final testing of apparatus designed to measure the intensity of X-ray doses

"Until now, no exact and uniform measurement of the strength of X-rays has been possible," said Dr Taylor. "Now a doctor may calibrate his apparatus to learn the intensity of his X-ray doses without the necessity of guesswork. He will not burn his patient, nor will he commit the worse crime, in cases such as cancer, of undertreating him."

According to Dr Taylor, there are two factors in X-ray treatment, the intensity and the penetrative power of the ray. The ray's penetrative power depends on the shortness of its wave length, longer waves having a burning effect. The intensity of the X-ray dose is more important, and it is this intensity which he can now measure.

For three months Dr Taylor experimented in European national standardizing laboratories, consulting foreign scientists and comparing his apparatus with theirs. Before that he labored at his instruments in the Bureau of Standards to construct a portable X-ray standard, finally building one which is so simple that he could take it with him, and so accurate and dependable that it is designated as the primary or final standard of the United States. This he compared with foreign instruments, drawing up with European scientists specifications for an international standard to remedy

international confusion. This new apparatus is the only one in the world that completely satisfies these specifications, Dr Taylor says.

Uncle Sam's X-ray yardstick is in reality a small metal chamber into which X-rays are projected in a steady, uniform beam. When the rays pass through the air in this chamber they ionize the air, that is, set loose free electrons. This causes the air to become a partial conductor of electricity, which may be measured by an electric current and meters. The strength of this current depends on the strength of the X-rays.

France, Dr Taylor said had been comparing X-rays with radium emission, but the X-ray intensity as thus measured varied with the ray's wave length. The English laboratories did not guarantee steady and uniform transmission of the ray being gauged. The American apparatus does away with both difficulties, and furnishes as nearly as possible a means for transmitting, maintaining, and measuring a ray of uniform and standard intensity independent of all other conditions. For this reason France, Egypt, and several other countries have adopted Dr Taylor's specifications outright, and other countries have drawn up specifications which at present his apparatus alone fits.

"It is now up to the Bureau," Dr Taylor said, "to find a means for gauging exactly the penetrative qualities of the various X-ray wave lengths. The intensity of a ray used in medical treatment is but half the problem. Not until we have both standards can we call our standardization work complete"—*Science Service*

THE DOLICHOCOLON

By F. D. LAROCHELLE, M.D., and E. E. SMITH, M.D., SPRINGFIELD, MASSACHUSETTS

REDUNDANCIES or elongations of the colon with loop formation have been observed by radiologists for a number of years, but it is only recently that the condition has been recognized as a definite clinical entity. The symptoms that arise from this condition are generally pronounced constipation, meteorism, and indefinite discomfort over the colon, associated with vague general symptoms such as indigestion, loss of weight, and insomnia. The patient complains of rumbling following the use of laxatives and cathartics, with only partial evacuation. The liquid intestinal contents are swept down by an exaggerated intestinal peristalsis to the elongated and dilated loop that acts as a trap and arrests the intestinal flow.

This condition has been variously described as elongation or redundancy of the colon with loop formation. Recently Chiray (1) has coined for this anomaly the term "Dolichocolon" from the Greek "*δολιγός*". The great advantage of such a term is that it can be transferred from one language to another without the necessity of translation, and the search of the literature is greatly facilitated.

It is impossible to give an exact definition of this condition, for, while the clinical features are fairly well established, the mechanism of the disease is anything but clear. While we must differentiate between elongation and dilatation of the colon, in most instances it appears that both factors are at work. Since we have become familiar with this condition, we have seen a number of patients presenting this ailment, and we can recall a number before that time whom we then classified erroneously as suffering from simple constipation.

By dolichocolon we understand an elonga-

tion of one or more segments of the colon. Another view is that this condition is due to a generalized elongation of the colon and that the redundancy and loop formation are but manifestations of an attempt of the colon as a whole to adapt itself to the abdominal cavity. Yet another view is that the condition is a form of megacolon in which the augmentation in length has been greater than the accompanying increase in caliber.

Anatomically, the dolichocolon is an elongation of the colon, most often involving one segment, usually the descending, resulting in flexures, loops, and kinks in the lumen of the gut. This may be accompanied by dilatation of the affected segment.

This condition was first recognized by pathologists, who, however, made no attempt to associate these findings with definite clinical symptoms. The work of Lane served to make diagnosticians conscious of these deformities and the advent of X-rays and the barium enema made it easy to recognize these anomalies during life.

White (2), of Boston, reports that he found this condition in from 4 to 5 per cent of patients presenting gastro-intestinal symptoms, this figure has been accepted as about the average incidence of the disease. Certain authors observed the condition more often in women than in men, but there is some doubt about this. All are agreed that it is more common in adult life and, although there may be exceptions to this, the individuals affected are usually of the viscerototic type. Our youngest patient was a 5-year-old female, the oldest, a 72-year-old man. While the condition may affect any part of the colon, it is by far more common in the sigmoid.

Numerous explanations have been offered but none is entirely satisfactory. It is prob-

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For three months Dr Taylor experimented in European national standardizing laboratories, consulting foreign scientists and comparing his apparatus with theirs. Before that he labored at his instruments in the Bureau of Standards to construct a portable X-ray standard, finally building one which is so simple that he could take it with him, and so accurate and dependable that it is designated as the primary or final standard of the United States. This he compared with foreign instruments, drawing up with European scientists specifications for an international standard to remedy

international confusion. This new apparatus is the only one in the world that completely satisfies these specifications, Dr Taylor says.

Uncle Sam's X-ray yardstick is in reality a small metal chamber into which X-rays are projected in a steady, uniform beam. When the rays pass through the air in this chamber they ionize the air, that is, set loose free electrons. This causes the air to become a partial conductor of electricity, which may be measured by an electric current and meters. The strength of this current depends on the strength of the X-rays.

France, Dr Taylor said, had been comparing X-rays with radium emission, but the X-ray intensity as thus measured varied with the ray's wave length. The English laboratories did not guarantee steady and uniform transmission of the ray being gauged. The American apparatus does away with both difficulties, and furnishes as nearly as possible a means for transmitting, maintaining, and measuring a ray of uniform and standard intensity independent of all other conditions. For this reason France, Egypt, and several other countries have adopted Dr Taylor's specifications outright, and other countries have drawn up specifications which at present his apparatus alone fits.

"It is now up to the Bureau," Dr Taylor said, "to find a means for gauging exactly the penetrative qualities of the various X-ray wave lengths. The intensity of a ray used in medical treatment is but half the problem. Not until we have both standards can we call our standardization work complete"—*Science Service*

colon, it is absolutely necessary to make a general examination. If the colon is examined first, some local lesion may be found that seems to explain the symptoms. The tendency then is to stop the study, but, if this is done, one can readily overlook other anomalies that might be of greater importance. Once it is definitely established that no other pathologic condition exists, attention is focused on the colon. The anus and anal canal are examined in the usual manner, a sigmoidoscope being introduced to exclude any lesion of the ascending colon involving the mucosa. Then the colon is emptied and washed by means of colonic irrigation. It may be necessary to repeat this, as oftentimes an unusual accumulation exists that is not readily dislodged at the first attempt. A barium enema, which is usually sufficient to demonstrate the condition, is then given to fill the entire colon and plates are made. Once the condition is recognized, it is well to empty the colon by another irrigation, because, if the pathology is marked, damage, or certainly discomfort might result from retention of a large amount of barium in the elongated loop. Then the patient is given barium by mouth and another plate is made in 24 hours. This demonstrates the condition conclusively.

TREATMENT

Many patients go on for years with this condition, with no other treatment than is usually practised for ordinary constipation. However, they invariably tell us that ordinary laxatives and cathartics do not have the usual effect, more relief being afforded by an enema although the discomfort is only partly relieved by the enema. The wave of enthusiasm for surgical treatment of this condition has passed now. It should be reserved for very special cases, and then only with great circumspection. It is probable that the results from surgical treatment have fallen far short of expected results.



Fig. 3 Elongation of the descending colon, with dilatation of the sigmoid in a child five years of age

If this condition is to be permanently relieved, we must first empty the whole colon, and then restore the normal tone of the colonic walls. After emptying, suitable diet with lubricants will facilitate the passage of intestinal contents through the elongated loop, leading to a disappearance of the exaggerated reservoir function of the affected segment. There can be no doubt but that this can be accomplished by medical measures.

In the way of laxatives, oil and agar emulsions with phenolphthalein are satisfactory. If necessary, a laxative pill can be given occasionally. During the first weeks of treatment, nothing will replace colonic irri-



Fig 1. A typical dolichocolon involving the sigmoid. Note the elongated sigmoid and the gas dilatation of the rectum.

ably fair to assume that all the factors enumerated are partly true, and that the resulting condition is a composite one, with emphasis on one or more features. While some authors think that the ailment is a congenital one, others believe that it is acquired. Pauchet claims that it is due to constipation. Zorzi thinks that the condition results from a derangement of the autonomous intestinal nervous mechanism. Others emphasize diet deficiencies or endocrine derangements as etiologic factors. At this time, the question cannot be definitely answered. An important fact to remember is that, whatever the condition may be, it can be made to disappear by medical measures and this would indicate that it is largely a functional derangement if there is a definite anatomic basis.

Why is the condition most common in the sigmoid? The sigmoid flexure is normally a reservoir. Dolichocolon is very likely an exaggeration of this function, in cases in

which the dimensions of the gut have exceeded normal anatomic limits and it is unable to regain its usual caliber. In a number of patients suffering from this condition, anal spasm can readily be recognized; it is natural to assume that this may be part of a spastic condition of the whole colon.

There are two distinct types of this disease—one associated with mucous colitis and spasm, and the other dyspeptic, with loss of appetite, indigestion, loss of weight, and indefinite discomfort in the abdomen.

The two complications that have been found are pericolic abscess and intestinal obstruction, but since these are rare and present no unusual features, they are not considered here.

In patients suspected of this condition, before undertaking examination of the



Fig 2. Elongated coils of the sigmoid without dilatation. Normal stomach and small intestine.

A NEW FEATURE IN IODIZED OILS¹

By FREDERICK R GREENBAUM, D Sc, CHICAGO

SINCE the introduction of iodized oil in therapy by Sicard and Forestier (1), its usefulness has been established, confirmed, and generally accepted by the medical profession for roentgen diagnosis and iodine medication. Sicard and Forestier produced an iodized poppy seed oil. Other iodized oils which are also available on the market to-day are iodized sesame oil and iodized rapeseed oil. Subsequently, brominated oils were also prepared. In all these halogenated oils, the unsaturated fatty acids of the oil are chemically combined with only one halogen, such as iodine, or bromine.

In 1897, E Merck, in Darmstadt (2) patented a method for making fats containing small amounts of iodine. In this patent the fact was emphasized that the presence of chlorine caused a darkening of the oil, and decomposition occurred in a very short time. If, however, quantities of the reagents forming iodine and chlorine in amounts below the theoretic one are used, then there were obtained stable oils containing iodine in amounts of 2, 5, 10, or 15 per cent and chlorine in very small amounts. In a patent (3) assigned to Merck and Company in 1909, Seifert points out that, up to that time, the following facts were known:

1 Complete treatment of fats with "chlor-iodine" yields "chloriodine" fats not stable and not suitable for medicinal use.

2 Complete treatment of fats with hydroiodic acid or with iodine and reducing agents yields iodine fats not stable and not suitable for medicinal use.

3 Incomplete treatment of fats with chloriodine yields stable chloriodine fats suitable for medicinal use.

Incomplete treatment of fats with hydroiodic acid or with iodine and reducing agents yields stable iodine fats fit for medicinal use. However, the incomplete treatment yields only fats or oils with a low percentage of iodine and a very low chlorine content.

In 1928 two physicians (4) prepared iodine trichloride by passing chlorine gas over iodine. This they then dissolved in water and shook it with corn oil. This oil was used for their sinus work. They did not mention the iodine content of the oil nor were they aware of the fact that the chlorine was most probably also combined chemically with the oil.

THE NEW FEATURE IN IODIZED OILS

This was the status of the attempts to prepare fatty oil containing both chlorine and iodine when the problem was taken up in our research laboratories in 1929. In selecting the oil for our study, we were guided by a high iodine value, low specific gravity, low content of the free fatty acids. We also considered (5) that the unsaturated fatty acids, especially linoleic acid, of the oil are highly responsible for the irritating action of iodized oils. Poppy seed oil contains about 65 per cent of linoleic acid, while peanut oil contains only from 21.6 to 24.7 per cent. From these considerations we finally decided to use peanut oil. Peanut oil, called Oleum Arachis, also, is composed chemically of the glyceryl esters of the following fatty acids: oleic, linoleic, palmitic, stearic and arachidic. In addition, peanut oil contains in small amounts high melting fatty acids such as the normal eicosanic, docosanic, and tetracosanic acids described by Taylor (6) and Yantzen and Tiedke (7). These last investigators doubt very much the presence of

¹From the G D Searle & Co Research Laboratories
Read before the Chicago Roentgen Society April 14, 1932

gations These empty and wash the colon, and repeated dilatation and contraction of the muscular walls combat the existing atony

While this condition is largely a local lesion, there are constitutional factors that must not be overlooked Attention should be paid to the endocrines, and a diet rich in vitamines may be indicated

Once a few cases exhibiting this condi-

tion have been recognized clinically, it will be found that it is more common than is generally known Every case of obstinate constipation may well be suspected of presenting one of these anomalies of the colon

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Reports Effects of Benzene, X-rays, and Radium on Blood Formation—Radium, X-rays, benzene and its various compounds, such as arsphenamine, are all known to produce injuries to the blood-forming tissues, especially the bone marrow, in certain doses and with certain susceptible persons On the other hand, these agents are used in the treatment of blood diseases In a report to the American College of Physicians, Dr Edwin E Osgood, M D , of the University of Oregon

Medical School, reviewed the effects of these agents and the conditions under which they exert an action upon the blood-forming tissues

It was stated by Dr Osgood that serious poisoning from these substances in the industries is not uncommon but might be prevented by periodic blood examinations, elimination of the more susceptible individuals, reduction of exposure by local ventilation in benzene cases, and the use of less toxic substances—*Science Service*

TABLE II—PHYSICAL CONTENTS OF PEANUT OILS

| | Oil from Virginia nuts | Oil from Spanish nuts | Oil from African nuts | Commercial oil |
|---------------------------------|------------------------|-----------------------|-----------------------|----------------|
| Specific gravity at 15° C. | 0.917 | 0.9175 | 0.911 | 0.9209 |
| Saponification value | 192.5 | 190.68 | 194.0 | 192.1 |
| Iodine value | 91.75 | 94.17 | 85.6 | 98.4 |
| Hehner value | 94.87 | 95.31 | | |
| Free fatty acids, as oleic acid | 0.55 | 0.79 | 0.62 | 6.2 |
| Cold test | +3° | +3° | +2° | +10° |
| Melting point of fatty acids | 29° | 34° | 30° | 28° |
| Solidifying point | 27.5° | 32.5° | 29.0° | 25° |

TABLE III—VARIOUS CONSTANTS OF VEGETABLE OILS AND THEIR HALOGENATED PRODUCTS

| Name of oil | Specific gravity at 15.5° C | Relative viscosity* | Iodine number | Saponification number | Acid value |
|--|-----------------------------|---------------------|---------------|-----------------------|------------|
| Peanut oil | 0.917 - 0.9209 | 5.24 | 83 - 103 | 189 - 196 | 0.5 - 5.0 |
| Iodochlorol (iodized and chlorinated peanut oil) | 1.290 | 103.01 | | | |
| Iodized ethyl esters of peanut oil | 1.21 | 4.24 | | | |
| Rapeseed oil | 0.9133 - 0.9168 | | 94 - 106 | 167.7 - 179 | 14 - 13.2 |
| Iodized rapeseed oil | 1.289 | 30.21 | | | |
| Poppy seed oil | 0.9255 - 0.9268 | | 132.6 - 136 | 190.1 - 197 | 0.7 - 11.0 |
| Iodized poppy seed oil 40 per cent | 1.340 - 1.350 at 20° C | 63.17 | | | |
| Sesame oil | 0.9203 - 0.9237 | | 103 - 115 | 188 - 197 | 0.23 |
| Iodized sesame oil 40 per cent | 1.370 - 1.372 | | | | |
| Olive oil | 0.9150 - 0.9180 | | 75 - 88 | 185 - 196 | 1.9 - 50.0 |
| Brominized olive oil 33 per cent | 1.16 | 3.77 | | | |

*The term relative viscosity used here was taken to = $\frac{\text{time} \times \text{density (oil)}}{\text{time} \times \text{density (water)}}$

gravity of 1.21, and are stable to light and heat

Table III shows the various physical properties of some vegetable oils and their halogenated products

From this table it is seen that iodized and chlorinated peanut oil has the highest relative viscosity of all halogenated oils, while the iodized and chlorinated esters of peanut oil have, with the exception of brominized olive oil, the lowest viscosity. Even the iodized and chlorinated peanut oil is suffi-

ciently heat stable to be sterilized by pasteurization

TOXICITY

Iodized and chlorinated peanut oil is non-irritating due to the fact that the iodine and the chlorine are firmly held in organic combination. The chlorine is just as firmly combined chemically as the iodine, so that no possible irritation could occur due to the presence of chlorine. The halogenated oil is also non-irritating due to the fact that the



Fig 1. Study of antrum, iodochlorol injection (Courtesy George D. Wolf, M.D., New York.)

lignoceric and isobehemic acids in peanut oil. This unique chemical composition is another reason why peanut oil was selected. No other vegetable oil offers such a wide variety of fatty acids as those contained in peanut oil, some of them being entirely specific for peanut oil only.

From a glance at Table II one will notice that peanut oil has a low specific gravity, a fairly high saponification value, and iodine value. The content of the free fatty acids in the native oils is very low. These physical properties make peanut oil a very suitable vegetable oil for the purpose of making halogenated oils.

We succeeded in introducing iodine and chlorine in peanut oil in such a fashion that the oil was saturated with halogens accord-

ing to the iodine number of peanut oil. One important feature in the manufacture of this halogenated oil is the fact that the free fatty acids are removed before and after halogenation, which removes the irritating properties and also affords remarkable stability to the halogenated oil.

This iodized and chlorinated oil, which is otherwise known as iodochlorol, contains about 27.5 per cent of iodine and 7.5 per cent of chlorine, so that the total content of halogen amounted to about 35 per cent. The action of chlorine and iodine is complementary and whether or not this results in a better shadow than produced by an oil containing iodine alone remains to be established. The halogenated oil so obtained has a brilliant yellow color, a specific gravity of 1.290 at 15.5°C., and a relative viscosity of 103, while the original peanut oil has a relative viscosity of 5.24.

ESTERS OF THIS HALOGENATED OIL

For many purposes, in fact for most purposes, this high viscosity of the halogenated oil is very desirable, but for some purposes, as in urologic work, a very low viscosity is desired. To accomplish this, we prepared the ethyl esters of peanut oil by esterifying the peanut oil with ethyl alcohol, introducing iodine and chlorine, which resulted in the formation of iodized and chlorinated esters of peanut oil, containing about 25 per cent of iodine and 7 per cent of chlorine. These esters are much more limpid than the oil, having a viscosity of 4.24, a specific

TABLE I.—FATTY ACID CONTENT OF TWO KINDS OF PEANUT OIL

| Oils from | Oleic acid per cent | Linoleic acid per cent | Palmitic acid per cent | Stearic acid per cent | Arachidic acid per cent |
|---------------|---------------------|------------------------|------------------------|-----------------------|-------------------------|
| Spanish nuts | 52.1 | 24.7 | 8.2 | 6.2 | 4.0 |
| Virginia nuts | 60.6 | 21.6 | 6.3 | 4.9 | 3.3 |

Wolf (10) praises iodized oil for the study of antra and recommends its use in large institutions as a routine procedure. In the usual displacement technic, Proetz (11) obtained very satisfactory results by the use of iodized oil.

In our own researches with our iodized and chlorinated peanut oil (iodochlorol) in sinuses, X-ray plates of deep shadow, clearness, and sharpness were obtained, unexcelled by those obtained with any other contrast medium.

Figures 1 and 2 are illustrations of the study of antra by means of our iodized and chlorinated peanut oil.

In bronchography through the use of iodized oils, considerable progress has been made within recent years. The non-irritating properties of iodo-chlorol make it well adapted for this use. Wood (12) recommended the oral administration of iodized oil as an aid to the differential diagnosis of upper lobe bronchiectasis and pulmonary tuberculosis.

After several injections of iodized oil by aspiration into the lungs, Singer (13) reports satisfactory results in a case of streptothricosis. Stiehm (14) gives complete credit to the insufflation of iodized oil for successful treatment of bronchiectasis. Hygienic living, postural drainage, rest, and the systemic effect from the iodine content of the iodized oil are all possible factors. Case histories show that patients treated with iodized oils do better than those without this treatment. Eschbach (15) reports on a pulmonary gangrene cured by tracheal injection of iodized oil. Surgical intervention in such cases is difficult and dangerous. Eschbach recommends the use of iodized oil before operation is performed. According to Iglauer (16), endo-

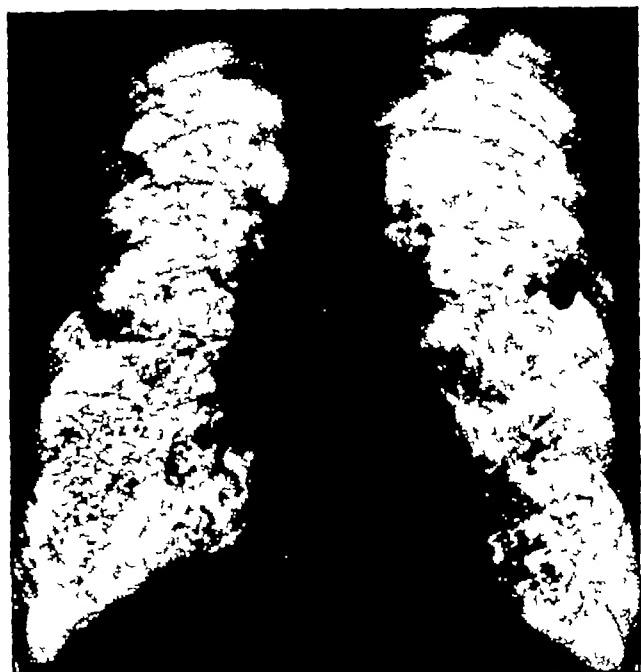


Fig 4 Study of bilateral bronchiectasis, iodochlorol by passive aspiration (Courtesy Hugo O Deuss, M.D., Chicago)



Fig 5 Exploration of fallopian tubes, iodochlorol injection (Courtesy Robert A Arens, M.D., Chicago)



Fig 2. Study of antrum, iodochlorol injection (*Courtesy Millard F Arbuckle, M.D., St Louis*)



Fig 3. Monilateral bronchiectasis, iodochlorol by passive aspiration (*Courtesy Hugo O Deuss, M.D., Chicago*)

peanut oil is highly refined before and after it is subjected to iodization and chlorination. It is, as has been established by animal experiments in our laboratories, of low toxicity and, therefore, well tolerated in large amounts. The esters of this halogenated peanut oil are likewise non-irritating and of low toxicity.

USES OF IODIZED OILS

In iodine medication, in cases in which large amounts of iodine are indicated, iodized and chlorinated peanut oil may be given in large doses, one to two teaspoonfuls, without producing any ill effects, such as iodism, etc. Iodized oils produce in general the same systemic effects as ordinary iodides, but their iodine is more slowly absorbed and excreted and they are more persistently retained in the tissues, especially in tissues rich in lipoids. The iodized oils generally pass the stomach unchanged and are saponified and absorbed in the small intestine. They are then deposited for the most part in lipoid tissues, in which they are gradually oxidized, yielding inorganic iodide, which is given off to the blood.

When a gradual long-sustained iodide action is desired, iodized oils have therapeutic advantages over ordinary iodides. Larger doses may be given than is the case in inorganic iodides without producing iodism.

In sinuses, recent investigators highly recommend the use of iodized oils for diagnosis (8, 9), pointing out that they can be injected into the various sinuses without harmful effects. Iodized peanut oil is particularly suitable in this field, because its viscosity is high and does not have to be diluted with heavy petrolatum or olive oil as is the case with other iodized oils.

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In our own investigations, we have found iodized and chlorinated peanut oil (iodochlorol) very suitable for the study of monolateral and bilateral bronchiectasis, particularly if three parts of iodochlorol are mixed with one part of the iodized and chlorinated ethyl esters of peanut oil. The results obtained are shown in Figures 3 and 4.

In gynecology, considerable work has recently been done on the exploration of the fallopian tubes and the uterus for sterility investigation. The leading researches of Stein and Arens (23) have opened this field, making it accessible to almost every obstetrician and gynecologist. They devised a new radiographic table for pelvic radiography with iodized oil and pneumoperitoneum, combined the method of pneumoperitoneum with the one of iodized oil instillation (24) and obtained very satisfactory results. According to Rubin and Bendick (25), iodized oils should not be injected into the uterus without first proving, by peruterine carbon dioxide gas insufflation, that the fallopian tubes are definitely non-patent. Witwer, Cushman, and Leucutia (26) assert that hysterosalpingography by means of iodized oil is a safe and simple procedure. In a series of 152 cases, the authors observed only one accident, that of a ruptured tube which did not lead to any ill effects. The method is of great diagnostic value in developmental anomalies of the genital organs, in tubal conditions leading to sterility, in certain carefully selected cases of pregnancy, and in uterine tumors. The method is contra-indicated in recent hemorrhagic inflammatory conditions that are not completely quiescent, active infections or malignant growths involving the cervix, previous intra-uterine intervention, uterine gestation in which a therapeutic abortion is not desired, infected cervical or uterine polyps, and fever. In certain instances, the injection of iodized oil is of direct therapeutic value.

Lash (27) successfully used iodized oil in

cases of uterus bicornis, bilateral salpingitis, and pelvic peritonitis. The function of the tubes was not disturbed by the iodized oil as the patient delivered a full-term child one year after injection. Lash, however, believes that, in the presence of infections in the female generative tract, the use of iodized oils is contra-indicated, as they have no antiseptic properties.

That our own studies have given very satisfactory results with iodochlorol for the exploration of the fallopian tubes can be seen from Figure 5, obtained with our iodochlorol.

USE OF IODIZED AND CHLORINATED ESTERS OF PEANUT OIL

While intravenous pyelography has certain theoretic values, in actual practice the main reliance is still based upon retrograde pyelograms. A good pyelographic medium must have the following properties to be of service to urologists:

- 1 It should give a good shadow.
- 2 It should have a low viscosity and should be miscible with water in all proportions.
- 3 It should be of low toxicity and free from all irritation.

Our research laboratories have succeeded in developing such a medium, called iodochlorol emulsion (Searle). The active ingredient in this emulsion is the iodized and chlorinated ethyl esters of peanut oil, containing about 25 per cent of iodine and about 7 per cent of chlorine. It has a specific gravity of from 1.19 to 1.22 at 25° Centigrade. It has a relative viscosity of 4.2. This extremely low viscosity makes the iodized esters very suitable for pyelographic work, as the emulsion has a still lower viscosity. The iodized ethyl esters of peanut oil are mixed with a small amount of mineral oil and emulsified with 10 per cent potassium oleate. The emulsion also contains 0.5 per cent benzyl alcohol.



Fig 6 Normal retrograde pyelogram, iodochlorol emulsion (Courtesy Earl Ewert, M.D., Chicago)

bronchial injection is well borne by the patient, no disturbing effects being encountered. He recommends slow injection with the use of a special intubation instrument. Injection of the oil is contra-indicated in febrile or cachectic patients and in those with cardiac decompensation. Expectoration is usually increased for a few days after the introduction of the oil, a considerable portion being thus ejected. The remainder is eliminated by absorption.

Singer (17) describes the introduction of the iodized oil into the lungs by pulling the tongue out as far as possible and introducing the iodized oil with a straight cannula and a 20 c.c. syringe. Perfect films of the bronchiectatic cavities of the lungs were obtained in 25 cases. Archibald (18) pointed out the fact that iodized oils are contra-indicated in cases of tuberculosis and infections of the upper respiratory tract. In an

interesting study, Pinkerton (19) pointed out that iodized vegetable oils do not produce any reaction and do not appear to injure the lungs in any way. Their removal from the lungs seems to be accomplished entirely by expectoration. Free fatty acids in the oil produce necrosis in the lung tissue. The degree of drainage and resulting fibrosis produced by an oil in the lungs depends largely on the amount of free fatty acids originally present and on the rapidity with which hydrolysis progresses. The almost complete lack of reaction to neutral vegetable oil in the lung is probably due to the absence of enzymes capable of hydrolysing the oil.

A unique study was made by Zalewski (20), who used Finikoff's method to increase the defensive mechanism of the organism by stimulating the lipolytic and the proteolytic power of the blood. This was accomplished by intramuscular injections of iodized oil and by the peroral administration of calcium salts. Zalewski reported excellent and lasting results with this method in osteo-articular tuberculosis, tuberculosis of the epididymis, and lymph node tuberculosis.

Faulkner (21) studied the uses of iodized oil in pulmonary suppuration and found that intrabronchial injections of iodized oils permit a study of "internal drainage." Internal drainage is the spilling of pus from a diseased bronchus to the neighboring bronchi of either lung.

Soresi (22) has facilitated greatly the use of iodized oil for intratracheal injection by working out a simplified technic. He injects the iodized oil through a syringe (the oil being kept lukewarm), inserting the syringe into a special cannula tongue depressor. He anesthetizes the organs thoroughly, which avoids dripping of oil into the esophagus even if the patient moves the head.

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The use of iodized oil in emulsion form was first studied by Neuswanger (28, 29), who, as early as 1926, reported favorably on its use as a pyelographic medium. Langenbeck (30), in Germany, obtained excellent pyelograms by the use of emulsified iodized oil. No evidence of irritation or other injurious complications were obtained and it was borne without reaction of any kind. Ehrenroth (31) used the iodized oil in non-emulsified form and, while he at first reported favorable results, he encountered difficulties because he used the oil as such and not in emulsified water-miscible form.

In our own researches we found that the dichlorol emulsion gave excellent pyelograms of great density and sharpness. The emulsion was well tolerated and no irritation or reactions of any kind were obtained. The emulsion was readily eliminated a few hours after the injection into the catheter. Pyelograms were obtained with this iodochlorol emulsion, Figure 6 being typical of all of them.

ACKNOWLEDGMENT

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(A) In sinus diagnosis, the high viscosity of the oil is an advantage.

(B) In bronchography, the non-irritating qualities of this oil and the viscosity, made controllable by adding the esters to the oil, make it particularly valuable.

(C) In gynecology, in recent studies of the exploration of the fallopian tubes, it has been found suitable.

(D) In pyelography, an emulsion of the esters was shown to have ideal properties for retrograde pyelograms.

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Viosterol Found Beneficial to Radium-poisoning Victims—Almost simultaneously with the news of the twentieth death from radium poisoning among the unfortunate watch factory workers, comes the announcement of a promising method of treating the condition Viosterol, now often given children in place of cod liver oil to prevent or cure rickets, has benefited a number of victims of radium poisoning, Dr Frederick B Flinn, of Columbia University, has reported to the American Medical Association Dr Flinn does not consider that he has a cure for the condition, but merely reports a method of treatment that has given promising results

"Our experience so far suggests a method of treatment that will eliminate radium salts from the organism as well as improve the condition of the bones if continued for sufficient time," he stated "It is a matter of months and not days Care should be taken that fresh preparations are used," he cautioned

Most conspicuous among radium-poisoning victims were the dial painters in the watch factory who used to put their radium-paint brushes in their mouths to point them In this way radium entered their bodies and in about one-fifth of the cases the radium was deposited in the bones instead of being eliminated While the amounts of radium ab-

sorbed in this way were small, the activity of radium is so great that these small amounts were sufficient to destroy bones and tissues and to cause fatal illness

How to get the radium out of the body before it had caused irreparable destruction was the problem which Dr Flinn and other scientists attempted to solve Because radium is related to calcium, it was supposed that any treatment that would affect calcium might have a similar action on the radium deposits, Dr Flinn explained So he first tried treatment with an extract of the parathyroid glands, because these glands are thought to regulate the calcium of the body Parathyroid treatment had been moderately successful, when Dr Flinn suggested the use of viosterol Vitamin D, calcium utilization in the body, bone formation, and the parathyroid glands are all linked together, so viosterol, which is a potent source of Vitamin D, was a logical selection

The results of this treatment in eight cases have been good In two cases, radium was completely eliminated from the body, in the other six, the amount of radium was materially reduced Improvement in general health, such as freedom from pain, gain in weight, and improved condition of the blood, followed the treatment In most of the patients the destruction of bone was checked —*Science Service*

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In all acute cases, roentgen treatments were given every 8 to 12 hours until pain was stopped, which usually occurred after from three to five treatments were given. Relief of tenderness usually required from five to seven more treatments. The discharge in most acute cases increased in quantity for from two to four days, when it began to lessen rapidly.

The average number of treatments in acute cases was from seven to 12. Most cases were dismissed in from five to 10 days. The subacute and chronic cases required a greater number of treatments over a longer period of time.

Technic—80 K V, 5 ma, filter, 5 mm Al and 2 inches of felt next to the skin area treated, cone, 3-inch, target distance, 13 inches, time, from 6 to 7 minutes, dosage, from 30 to 35 ma-minutes.

SUMMARY

Some of the advantages of roentgenotherapy of mastoiditis are:

- (1) Treatment at once stops further invasion and destruction of mastoid cells.
- (2) Pain begins to lessen, following the first treatment.
- (3) The discharge is thinned and increased, when all pain and tenderness are relieved, the drainage stops.
- (4) No diseased areas of the mastoid cells are missed as the treatment covers the entire mastoid.
- (5) The treatment is painless.
- (6) The course of the disease is shortened.
- (7) The danger and pain attending surgical operation are avoided.

Some of the disadvantages are:

- (1) Temporary loss of hair over the area exposed to X-rays. The hair, however, comes in thicker than before in about three months.
- (2) Dermatitis of the area exposed to

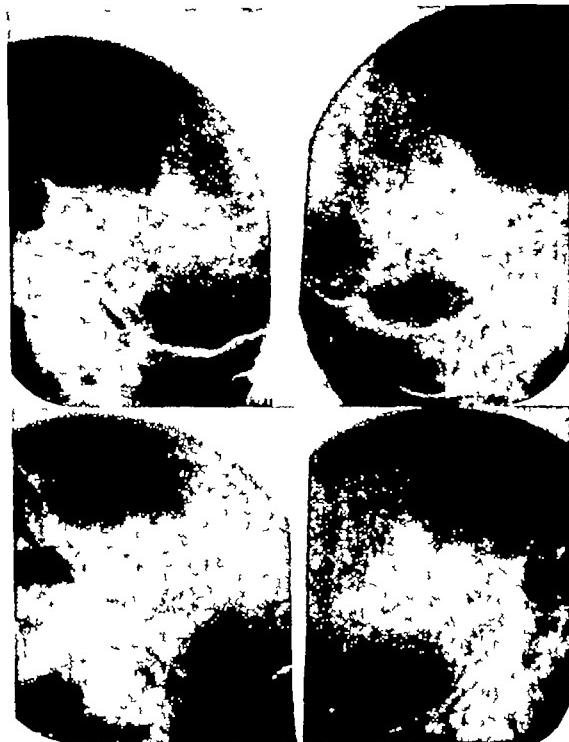


Fig 1-A (*upper*) Case 11. The film was made five days after the onset of the disease. While the left mastoid is clear, the right mastoid shows marked cloudiness of the cells of the antrum. Antral cells are filled with exudate and cell walls are faintly outlined. A condition of acute purulent mastoiditis prevails in the antral cells. The anterior wall of the sigmoid sinus is quite well outlined, which is corroborative evidence of purulent mastoiditis. Cells in the tip of the mastoid are not clouded. The cells posterior to the sigmoid sinus are definitely hazy, but the cell walls are not destroyed, indicating simple mastoiditis in this area. The superior cells of the mastoid are markedly cloudy and the cell walls are not visible, indicating acute purulent mastoiditis in this area.

Fig 1-B (*lower*) The same case, the film having been made 13 days after Figure 1-A. Cloudiness of some of the antral cells is less pronounced. The anterior wall of the sigmoid sinus is not so definitely pronounced. Cells posterior to the sigmoid sinus are less hazy, and trabecular walls are more definitely outlined. Cells of the superior mastoid area are noticeably less hazy. The condition of all the mastoid cells shown definitely demonstrates that no further invasion or destruction of trabeculae occurred after roentgenotherapy was begun.

X-rays, which, however, can be prevented by proper filtration, the application of salted butter once a day over the exposed area, and the application of a very mild high frequency current of electricity through a vacuum electrode.

TREATMENT OF MASTOIDITIS WITH X-RAYS¹

By WILLIAM L. ROSS, M.D., OMAHA, NEBRASKA

DURING the past 17 years, I have treated 41 cases of mastoiditis with X-rays. Of these, 16 acute cases were seen in children. Of the adults, 15 were acute, seven subacute, and three chronic.

The chief complaints in all were pain, tenderness to pressure over the mastoid, and discharge from the ear. The pain was generally of a deep, boring character, quite constant, accompanied at times by sharp shooting pains. These symptoms were generally preceded by an acute cold in the head, sore throat, and earache. Tenderness to pressure was generally more marked over the antrum and tip of the mastoid, but, at times, it was felt over the entire mastoid. Discharge from the ear varied from a thin, serous to a rather thick, creamy exudate.

All of the 16 children suffering from acute mastoiditis felt more or less relief from pain in the middle ear upon spontaneous rupture or paracentesis of the tympanic membrane. But pain in the mastoid continued and the discharge from the ear, in most cases was quite profuse, indicating mastoiditis.

Chief complaints in all adult cases were a constant, deep-seated, dull pain accompanied at times by sharp, shooting pain. Also, most cases complained of a swishing sound that corresponded with the heart beat. All had marked tenderness to pressure over one or more areas of the mastoid.

Symptoms.—The temperature varied from subnormal to 103° Fahrenheit. All exhibited increased pulse beat, and more or less malaise, etc. Previously 10 of the patients had been diagnosed by one or more

doctors as presenting acute mastoiditis and been advised to be operated on at once.

Of the seven cases of subacute mastoiditis, all gave a history of having had an acute attack of more or less severity from two to four months previous to examination. All complained of a deep-seated pain which varied in severity but was more or less constant. All complained of noises in the ear, and some heard the swishing sound, corresponding with the heart beat. All had tenderness to pressure over some part of the mastoid. Some had discharge from the ear. In all the hearing was impaired to varying extents. Some had a subnormal temperature and some a slight rise in temperature at some time during each 24 hours.

Of the three cases of chronic mastoiditis, all had had acute mastoiditis from four to six months previous to examination. All had complained of some pain and tenderness to deep pressure over the mastoid. Some had discharge from the ear. In all, the hearing was pronouncedly impaired.

Diagnosis.—In all cases, the diagnosis was made from the character and location of the pain, the degree of tenderness to superficial or deep pressure, and the quantity, rather than the character, of the discharge from the ear.

The extent of mastoid cells involved, the amount of exudate, and the destruction of the trabeculae were judged by a study of X-ray films of the normal and diseased mastoids. No attempt was made to differentiate the borderline medical or surgical cases.

All the foregoing cases were treated with X-rays. The technic number of treatments, and length of time during which treatment was given were varied to suit the case.

¹Read before the Radiological Society of North America, at the Seventeenth Annual Meeting, at St. Louis Nov. 30-Dec. 4, 1931.



Fig 3 Case 31 The film was made two months after the onset of disease. The right mastoid is rather small but of a pronounced pneumatic type. The anterior wall of the sinus is shown extending through the mastoid and below the tip of the mastoid. All the cells of the left mastoid are markedly cloudy. The anterior wall of the sigmoid sinus is faintly outlined. Posterior to the sigmoid sinus is a large area with varying densities of shadow, surrounded by a fairly well marked border. This area is evidently an abscess cavity, which drained into the soft tissues of the neck through a perforation of the cortex at the tip of the mastoid.

Fig 4 Case 39 The film was made about two years after the onset of mastoiditis. The left mastoid is clear with rather large pneumatic cells. The right mastoid shows marked cloudiness of the tip of the mastoid, some cloudiness of antral cells, quite marked cloudiness of a small area of superior mastoid cells, marked haziness of cells just superior to the mandibular fossa of the temporal bone, and marked cloudiness in the posterior border cells of the mastoid. This shows a wide distribution of infection of the mastoid cells with a fairly clear area of cells just anterior and posterior to the sigmoid sinus.

had had whooping cough and chicken pox. She had had measles in January, 1924.

Physical examination revealed swelling over the right mastoid. The tympanic membrane had a small opening in it and there was quite a discharge from the ear. The area over the antrum of the mastoid was tender to pressure but the tip of the mastoid was not.

The patient, who had come in from an automobile trip of 150 miles, looked sick and tired.

Temperature, 101°, respirations, 40, pulse, 120.

X-ray films showed a cloudiness of the cells in the antrum of the mastoid on the right as compared to the left.

On April 24, at 5 P.M., the patient was given an X-ray treatment over the right mastoid and that night she had less pain. On April 25 and 26, she was given two treatments each day. The pain was noticeably less following each treatment. On April 27, at 9:00 A.M., the child was free

from pain. She had slept well the preceding night. On April 27, 28, 29, and 30 she was given one treatment each day, a total of nine treatments. After April 30 no more X-ray treatments were given.

On May 2, all discharge from her ear had stopped and she felt no tenderness to deep pressure over the mastoid. She was dismissed as cured. An X-ray film was taken on May 7 which showed that infection did not extend after X-ray treatments were begun.

Case 13 July 11, 1924, G.J., age 28 years. The patient's chief complaint was of some mastoid trouble and discharge from the left ear. The patient had just come from consulting a physician who had been treating him for some time for mastoiditis and had repeatedly advised mastoid operation. G.J. came to me, he said, for treatment rather than examination and diagnosis, but I took a brief history of the present illness.

The patient had had acute mastoiditis



Fig 2-A (upper) Case 13. The film was made three months and 24 days after the onset of the disease. The right mastoid, though not complained of, is small and the cells are poorly outlined. It is not normal. The left mastoid shows marked cloudiness in the cells of the antrum. The tip of the mastoid is slightly hazy. The anterior wall of the sigmoid sinus is clearly outlined. In fact the whole lumen of the lateral and of the sigmoid sinus are quite well outlined. The cell walls overlying the sigmoid sinus are quite irregular in outline and for the most part have been destroyed and absorbed. The sinus itself is not infected. The cells posterior to the sigmoid canal are definitely filled with exudate and cell walls are destroyed. The whole picture is that of subacute, purulent mastoiditis.

Fig 2-B (lower) The same, made one month subsequent to the film above. The antral area and the area posterior to the sigmoid sinus are definitely less cloudy and show signs of absorption of the exudate. The posterior canal wall is clearly seen. The superior cells of the antrum, though small, show signs of clearing up.

CASE REPORTS

Case 1 May 3, 1914, Alice D., age 8 years. The patient had been suffering for seven days with severe pain, which began in the middle ear, spreading, in two days, to the mastoid. On the third day of the pain in the middle ear, spontaneous rupture of the tympanic membrane occurred, greatly

relieving the pain in the middle ear. Although the middle ear discharged freely, it did not relieve the pain in the mastoid. Examination revealed a marked localized swelling over the mastoid. I made a diagnosis of acute mastoiditis with subperiosteal abscess and advised mastoidotomy.

The child's aunt objected to operation and asked me to try roentgenotherapy to relieve the pain. This I promised to do, if I were permitted to lance the subperiosteal abscess which had perforated the cortex of the mastoid. The abscess was lanced and frequent irrigations of the wound and ear canal were made each day. Since the pain in the mastoid, though somewhat less, continued, I gave X-ray treatments on five consecutive days. Following each treatment the pain was noticeably less, and by the fifth day had stopped. The drainage from the wound and middle ear, although much lessened, continued. On the fifteenth day, the discharge from the middle ear had ceased and the external wound was healed. I gave one more X-ray treatment and dismissed the patient. No X-ray films were made of this case.

Case 11 April 24, 1924, L. N., aged 8 years. The chief complaint was pain in right mastoid. On April 19, the patient began suffering quite suddenly with severe pain in her right ear. Two days later, pain commenced behind her ear. Paracentesis was done on the second day, greatly relieving the pain in her middle ear but the pain in her mastoid was more marked and continuous with exacerbation. On the third day her physician asked for consultation.

On April 23, a general surgeon and an eye, ear, nose, and throat specialist were consulted. All diagnosed acute mastoiditis and advised immediate operation.

The child's personal medical history was negative except that, during the year preceding examination, she had suffered three attacks of earache, of short duration. She

his right ear canal showed occasional pneumococci and waxy material

X-ray films of the mastoids showed cloudiness of the tip of the right mastoid, of the antrum and superior cells of the mastoid, and of the cells just superior to the mandibular fossa of the temporal bone. X-ray films of the maxillary sinus showed evidence of chronic sinusitis.

X-ray treatment was begun Aug 27, 1929, and during the succeeding 14 days he was given 10 treatments. In September, 1929, he had less pain in his right mastoid and right temporal region. Tenderness to deep pressure over the mastoid and temporal region was lessened. During September he was given eight treatments, during October, 10 treatments, during November, but one treatment. During December he was given seven treatments, making 36 treatments in all. On January 1, 1930, he was free from pain in his right mastoid and right temporal region. Deep pressure over the mastoid and temporal region did not cause pain. The singing noise in his ear was not constant and was less pronounced. He was then dismissed as cured except for his maxillary sinusitis.

Case 41 Dec 13, 1930, I T, aged 10 months. Chief complaints were an abscess behind his left ear, discharge from the ear, and swelling of the left side of the face.

During the night of Nov 30, 1930, the baby suffered with earache. The following morning his ear began to discharge freely. At the end of one week the discharge was much less and a swelling was noticed just behind the left ear. December 11, twelve days from the onset of otitis media, the attending physician lanced the swelling over the mastoid and a small amount of pus exuded. On December 12 his face began to swell and his left eye was so swollen as to be shut. An eye, ear, nose, and throat specialist was consulted, who advised that the baby be operated on.

Physical examination, made on December 13, revealed a temperature of 100° F., pulse 110, respirations 40. Inspection revealed a marked swelling over the left mastoid. A closed wound was seen about the lower border of the antrum. The swelling extended above and in front of the ear. The left eyelids were badly swollen, and the left side of the face, as well as the lymph nodes of the left side of the neck, were swollen and tender.

Blood count red blood cells 3,900,000, white cells 20,000, hemoglobin 50, polymorphonuclears 60.

The abscess was lanced and a free discharge of pus followed.

X-ray films showed a cloudiness of the mastoid cells, and also the point of rupture of the abscess through the cortex of the mastoid. The diagnosis was mastoiditis with subperiosteal abscess.

This case is of particular interest in that the condition had clearly passed the medical phase of mastoiditis into that phase demanding surgery and in that we were able to demonstrate mastoid cells in a baby 10 months old.

During the first four days, eight X-ray treatments were given over the mastoid. Following the first treatment, the baby began to rest better. From Dec 13, 1930, to Jan 9, 1931, 21 X-ray treatments were given over the mastoid and three treatments over the enlarged lymph nodes of the neck. By Jan 9, 1931, the wound over the mastoid had healed, the discharge from the ear had stopped, and there was no tenderness to pressure over the mastoid. The case was dismissed as cured.

CONCLUSIONS

1. X-ray treatment is applicable in almost all phases of mastoiditis.

2. Results of X-ray treatment of mastoiditis are satisfactory to the patient and the roentgenologist.

March 20, 1924, the pain commencing suddenly in his left ear, following a head cold and sore throat. The ear discharged constantly from the latter part of March and he had experienced pain and tenderness over the left mastoid all the while. At the time of examination, the tenderness was more marked than common.

Physical examination revealed his temperature to be 100°, pulse 100, respirations 20. Localized swelling over the mastoid was marked and tenderness too acute to permit pressure examination. The blood count on July 11 showed red cells, 5,880,000, white cells, 14,400.

Films of the mastoid showed cloudiness and filling of the cells of the left mastoid anterior to, and overlying, the sigmoid sinus, also cloudiness of the tip of the mastoid, contrasting markedly with the cells of the right mastoid, which was not normal.

The diagnosis was exacerbation of subacute mastoiditis.

On July 12, he returned for treatment, receiving 12 X-ray treatments during a period of 14 days. The pain was less following each treatment and by the fourth day had stopped, but the discharge from his ear had increased.

On July 17 the white cell count was 8,400, a reduction of 6,000 white cells in six days.

Fourteen days from the beginning of treatment (July 26), he was free from all pain and tenderness over the mastoid, and the discharge had stopped. The patient was dismissed with a request to return on August 12 for X-ray films, which he did. Films made then showed marked clearing of the mastoid cells. On October 12, the patient again returned. He said he had had no further pain or discharge from the left ear and was feeling well.

Case 31 Mrs W S, age 23 years. The patient, who was referred July 2, 1928, for X-ray treatment of mastoiditis, had been suffering with varying degrees of pain in

her mastoid since May 1. On June 25, she suffered a very acute exacerbation of mastoiditis and was very ill, having a temperature of 104° F for several days.

The history of the present illness, together with the physical examination and X-ray films, compelled a diagnosis of von Bezold's abscess. Bezold's abscess, a term used to denote an abscess which has formed below the mastoid process, is caused by a subperiosteal abscess of the tip of the mastoid perforating its cortex and discharging into the soft tissues of the neck. The point of perforation at the tip of the mastoid was clearly shown in the X-ray film (Fig. 3).

X-ray treatments were begun at once and, as usual, noticeable lessening of the pain followed each treatment. During the night of July 5, after five treatments had been given, the patient slept well. By July 13, nine treatments had been given. The pain in the mastoid and discharge from her ear had stopped and the patient was referred again to her physician.

Case 39 Aug 15, 1929, Mr G, aged 57 years. Chief complaints were of pain in the right mastoid and ear, in the right side of the face, in the right temporal region, and impairment of hearing.

For two years preceding the present examination, Mr G had suffered in varying degrees with a dull, aching pain in his right mastoid. Pain was constant. He also had heard a buzzing, singing noise in the right ear. The pain in his face and temple was not constant, the character varying from dullness to sharpness. All of his pains increased when he had an acute cold.

On physical examination, he was tender to deep pressure over the tip of the mastoid and over the antrum and superior mastoid cells. He was also tender to pressure just superior to the mandibular fossa of the temporal bone. He presented an eroded, red condition of the external ear canal but no discharge from his ear. A smear from

his right ear canal showed occasional pneumococci and waxy material

X-ray films of the mastoids showed cloudiness of the tip of the right mastoid, of the antrum and superior cells of the mastoid, and of the cells just superior to the mandibular fossa of the temporal bone. X-ray films of the maxillary sinus showed evidence of chronic sinusitis.

X-ray treatment was begun Aug. 27, 1929, and during the succeeding 14 days he was given 10 treatments. In September, 1929, he had less pain in his right mastoid and right temporal region. Tenderness to deep pressure over the mastoid and temporal region was lessened. During September he was given eight treatments, during October, 10 treatments, during November, but one treatment. During December he was given seven treatments, making 36 treatments in all. On January 1, 1930, he was free from pain in his right mastoid and right temporal region. Deep pressure over the mastoid and temporal region did not cause pain. The singing noise in his ear was not constant and was less pronounced. He was then dismissed as cured except for his maxillary sinusitis.

Case 41 Dec 13, 1930, I T., aged 10 months. Chief complaints were an abscess behind his left ear, discharge from the ear, and swelling of the left side of the face.

During the night of Nov. 30, 1930, the baby suffered with earache. The following morning his ear began to discharge freely. At the end of one week the discharge was much less and a swelling was noticed just behind the left ear. December 11, twelve days from the onset of otitis media, the attending physician lanced the swelling over the mastoid and a small amount of pus exuded. On December 12 his face began to swell and his left eye was so swollen as to be shut. An eye, ear, nose, and throat specialist was consulted, who advised that the baby be operated on.

Physical examination, made on December 13, revealed a temperature of 100° F., pulse 110, respirations 40. Inspection revealed a marked swelling over the left mastoid. A closed wound was seen about the lower border of the antrum. The swelling extended above and in front of the ear. The left eyelids were badly swollen, and the left side of the face, as well as the lymph nodes of the left side of the neck, were swollen and tender.

Blood count red blood cells 3,900,000, white cells 20,000, hemoglobin 50, polymorphonuclears 60.

The abscess was lanced and a free discharge of pus followed.

X-ray films showed a cloudiness of the mastoid cells, and also the point of rupture of the abscess through the cortex of the mastoid. The diagnosis was mastoiditis with subperiosteal abscess.

This case is of particular interest in that the condition had clearly passed the medical phase of mastoiditis into that phase demanding surgery and in that we were able to demonstrate mastoid cells in a baby 10 months old.

During the first four days, eight X-ray treatments were given over the mastoid. Following the first treatment, the baby began to rest better. From Dec 13, 1930, to Jan 9, 1931, 21 X-ray treatments were given over the mastoid and three treatments over the enlarged lymph nodes of the neck. By Jan 9, 1931, the wound over the mastoid had healed, the discharge from the ear had stopped, and there was no tenderness to pressure over the mastoid. The case was dismissed as cured.

CONCLUSIONS

1. X-ray treatment is applicable in almost all phases of mastoiditis.

2. Results of X-ray treatment of mastoiditis are satisfactory to the patient and the roentgenologist.

March 20, 1924, the pain commencing suddenly in his left ear, following a head cold and sore throat. The ear discharged constantly from the latter part of March and he had experienced pain and tenderness over the left mastoid all the while. At the time of examination, the tenderness was more marked than common.

Physical examination revealed his temperature to be 100°, pulse 100, respirations 20. Localized swelling over the mastoid was marked and tenderness too acute to permit pressure examination. The blood count on July 11 showed red cells, 5,880,000, white cells, 14,400.

Films of the mastoid showed cloudiness and filling of the cells of the left mastoid anterior to, and overlying, the sigmoid sinus, also cloudiness of the tip of the mastoid, contrasting markedly with the cells of the right mastoid, which was not normal.

The diagnosis was exacerbation of subacute mastoiditis.

On July 12, he returned for treatment, receiving 12 X-ray treatments during a period of 14 days. The pain was less following each treatment and by the fourth day had stopped, but the discharge from his ear had increased.

On July 17 the white cell count was 8,400, a reduction of 6,000 white cells in six days.

Fourteen days from the beginning of treatment (July 26), he was free from all pain and tenderness over the mastoid, and the discharge had stopped. The patient was dismissed with a request to return on August 12 for X-ray films, which he did. Films made then showed marked clearing of the mastoid cells. On October 12, the patient again returned. He said he had had no further pain or discharge from the left ear and was feeling well.

Case 31 Mrs W S, age 23 years. The patient, who was referred July 2, 1928, for X-ray treatment of mastoiditis, had been suffering with varying degrees of pain in

her mastoid since May 1. On June 25, she suffered a very acute exacerbation of mastoiditis and was very ill, having a temperature of 104° F for several days.

The history of the present illness, together with the physical examination and X-ray films, compelled a diagnosis of von Bezold's abscess. Bezold's abscess, a term used to denote an abscess which has formed below the mastoid process, is caused by a subperiosteal abscess of the tip of the mastoid perforating its cortex and discharging into the soft tissues of the neck. The point of perforation at the tip of the mastoid was clearly shown in the X-ray film (Fig 3).

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REFERENCES

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- 2 Idem The Treatment of Infections of the Mastoids of Infants, When There Is No Sign of Destruction Present, with Fractional Doses of Roentgen Rays New Orleans Med and Surg Jour, August, 1931, LXXXIV, 111-113

Insanity a Matter of Colloid Chemistry—A permanent change in the brain means abnormal thinking, which we call insanity, says Dr Wilder D Bancroft, Professor of Chemistry at Cornell University. When we boil an egg, the white coagulates. When we dissolve rubber in benzine, the rubber is dispersed. No such extreme changes take place in the brain, but there are two types of insanity, in one of which the brain is more coagulated than usual and in the other of which it is more dispersed than usual.

If a person is suffering from the coagulation type of insanity, drugs which counteract coagulation will help the patient. This has been done successfully by administering bromides and could probably be done better by the use of thiocyanates. If a person is suffering from the dispersion type of insanity, alleviation will be obtained by giving a drug which will tend to coagulate the brain tissues.

In 1921, Berger gave cocaine to eleven patients suffering from catatonic stupor and found that the majority of them became active immediately after the first injections, though the improvement did not last more than an hour or two. In 1930, Lorenz anesthetized a similar patient with sodium amyta.

All anesthetizations involve coagulation, and the patient passed through a normal state on coming out from the anesthetic and before lapsing into the catatonic stupor. This patient was in an aroused mental state for about four hours, after which she fell into a natural sleep for five hours. Later the symptoms of mutism, muscular rigidity, and active negativism developed slowly.

Dr Langstrass, of St Elizabeth's Hospital in Washington, has reported that he has ad-

ministered carbon dioxide and oxygen in suitable proportions to a patient who had suffered from catatonic stupor for ten years. This, coupled with other treatment, has kept the patient in an apparently normal state for nearly two years, a remarkable medical triumph.

Of course, treatments of this sort will not restore brain tissue which has been eaten away by syphilis or anything of that sort, but they will enable the physician to get the coagulated tissue back into a more nearly normal state.

Over-doses of a dispersing agent should give a normal person a dispersion type of insanity, while over-doses of a coagulating agent should give the coagulation type of insanity. Naturally, there are not many data on this point because nobody wishes to make a sane person insane. When treating persons for high blood pressure, it has been found that continued administration of large doses of sodium thiocyanate gave rise to hallucinations of sight and hearing, mania, confusion, and ideas of persecution, singly or in combination. Since the patients recovered in a week after giving up the drug, these were cases of temporary insanity.

The exclusion of oxygen causes unconsciousness due to asphyxiation. When the oxygen is not cut down so much, interesting mental reactions occur. Aviators may become incapacitated temporarily when flying at high altitudes. There is a height for each aviator above which it is not safe for him to go, as he may develop mental confusion, leading to errors of performance, sometimes hallucinations of sight and hearing, and, in some cases, an uncontrollable desire to sing and whistle. This last is rather an anticlimax.—*Science Service*

RECORDS IN ROENTGEN THERAPY¹

By CARL L. GILLIES, M.D., CEDAR RAPIDS, IOWA

NO absolute, fixed rules can be laid down concerning the keeping of records in roentgen therapy. Whether the practice is hospital, clinic, or office will influence the type and general form, although certain underlying principles and minimum requirements are necessary and applicable to all kinds of practice. The necessity of making complete and accurate records cannot be over-emphasized. To insure their being kept up they should be simple and concise. It is advisable to have the records in the roentgenologist's own handwriting. This avoids the possibility of error in transcription and such an original record is of greater value than a dictated or copied one if it should have to be produced in court. A good record should include the following points:

1. A brief but adequate *clinical history* of the patient, the age, sex, and previous history, the onset and duration of the present illness, all previous medical and surgical treatment, and, in particular, all previous radiation treatment. Each disease presents its own problems and certain phases of the history must be noted as they suggest themselves. Detailed and voluminous notes of former illnesses which obviously have no bearing upon the condition under treatment can well be omitted.

2. The weight of the patient and the dimensions by actual measurement. These data are, of course, unnecessary in dermatologic practice or in cases in which the lesion is superficial.

3. The *diagnosis, size, and location* of the lesion. If it is within the body, the distance from the surface, or surfaces, through

which treatment is to be given, must be noted.

4. The *factors* employed in sufficient detail to permit the determination of the quality and intensity of the dose applied to the skin.

These factors are

- (a) *Kilovolts*
- (b) *Milliamperage*
- (c) *Anode-skin distance*
- (d) *Size of field*
- (e) *Filter material and its thickness*
- (f) *Length of exposure*

These six factors determine the size of each dose which should be recorded as

(g) *The Size of the Dose in Absolute Units*—The record should show whether the dose in r has been estimated or actually measured.

The kilovoltage and filter determine the quality or hardness which should be noted as

(h) *Quality* expressed in terms of the effective wave length or the half value layer.

(i) The *date* of each treatment is necessary so that the interval between treatments will be known and the loss of effect can be roughly estimated.

It is also necessary that the records show the dose applied to the lesion. This can be determined from the above data. In our own practice we find it satisfactory to record it as

(j) *The depth dose percentage* which is assumed to represent the percentage of each skin dose which reaches the depth of the lesion. The proportion of the beam reaching the lesion is read from distribution charts of our various standard technics. Accurate measurements of the patient, an exact localization of the lesion, and reliable distribution charts are all essential in order

¹Presented before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis Nov. 30-Dec. 4, 1931.

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MEDICO-LEGAL DEPARTMENT

CONTRIBUTIONS¹ by I S TROSTLER, M D , CHICAGO

MENOPAUSE FOLLOWING A SINGLE APPLICATION OF ROENTGEN RAYS TO THE HEAD

A Ridiculously Assumed Conclusion

Rulison vs Victor X-ray Corporation
(Iowa), 223 N W R 745

The Victor X-ray Corporation, through one Watson, was installing a second-hand roentgen-ray machine in a physician's office, with a view to its sale To make a demonstration, Watson requested the physician's office secretary and assistant to submit to an exposure from the machine She did so, and later, claiming to have been injured thereby, brought suit Judgment was rendered in her favor The defendant appealed to the Supreme Court of Iowa, but the judgment was affirmed

In demonstrating the roentgen-ray machine it had installed, the defendant, through its agent Watson, applied the cone to the plaintiff's head and took three films in succession, with brief intervals, at one sitting The focal point was the occipital lobe of the brain Some days later the plaintiff began to feel soreness in her head Subsequently she lost her hair from an area four inches square She became subject to a chronic condition of sick headaches, referred to in the record as "ophthalmoplegia migraine" The "muscles of accommodation of the pupil" of her right eye ceased to function, and the eyelid was affected The menopause came on, although the plaintiff was only 36 years old Watson testified that nothing occurred that would have caused a burn He estimated the dosage at 580 milliampere-seconds, concededly a normal dosage that could not result in injury The testimony on both sides, however, in-

dicated that the loss of hair was the result of a second degree roentgen burn and that it could not have occurred if less than 1,200 milliampere-seconds had been applied A technician who saw the demonstration testified that its duration was longer and the distance from the focal point shorter than were indicated by Watson She testified, too, to the heating of wires, which required an interval of stoppage to cool them and indicated a want of control of the dosage The defendant contended that there was no evidence of negligence, but the Supreme Court was of opinion that there was enough to take the question to the jury

The defendant took exception to the refusal of the trial court to withdraw from the jury all evidence concerning the plaintiff's menopause and the impairment of her vision, claiming that there was no evidence to show a causal relation between those conditions, if they existed, and the application of the roentgen rays The court pointed out, however, that Dr Heagey, a witness for the plaintiff, testified that the third cranial nerve, which controls substantially all of the muscles of the eye [sic], has its origin about the focal point toward which the roentgen rays were directed, that an overdosage of roentgen rays causes a swelling of the blood cells, which results in an obstruction of the circulation and breaks down the small veins, and that any breaking down of the circulatory system necessarily shuts off the blood supply to parts of the body dependent upon it Dr Francis W Heagey (an Omaha internist) testified, too, that although roentgen rays would not be applied to a woman's head for the purpose of producing sterility, yet an excessive dosage of roentgen rays might penetrate to more or less remote parts of the body, and

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to estimate the sum of the depth doses with a reasonable degree of precision

5 The degree of *reaction* and date of observation should be noted

This includes both the local changes and any constitutional symptoms that may develop

6 The *results* of treatment, both immediate and late, to include follow-up notes at suitable intervals, should also be recorded

The general form of record used will depend largely upon the type of practice and whether the roentgen record is to become a part of the patient's hospital chart or is to be filed for office reference. In a clinic or hospital practice printed forms the size of

the hospital chart are convenient, separate printed blanks being used for the history, present illness, treatment record, and follow-up notes. Printed anatomical charts may be prepared upon which the location of the lesion can be marked. Filling in such separate blanks and charts is likely to be too cumbersome for the busy general roentgenologist in office practice. A printed card index system is more convenient, one side of the card being ruled vertically to provide spaces for the date of each treatment and the physical factors used. The back of the card is left blank for the history, dimensions of the patient, description and location of the lesion, and progress notes.

Waves of Electrons will Tell of Crystal Structure—Waves of electrons will soon allow the scientist to obtain a clearer picture of the internal structure of crystals than ever before possible, Dr C J Davisson has predicted to the American Association for the Advancement of Science and the American Physical Society. Very short wave lengths are available in electron waves and this results in greater power to photograph the fine crystal structure of matter. Dr Davisson is a pioneer in the use of electron waves, since he won international fame a few years ago by proving that electrons act like waves in much the same way as light and X-rays. He has also developed lenses for concentrating the beam of electrons. Since the electron is what may be termed a particle of electricity, his work bridges the previous gap between matter and electricity.

Just as shortening the wave length of light

used in illuminating a microscope allows smaller objects to be seen, use of electrons made visible by their effects on photographic plates allows physicists to study more minute structure in crystalline matter, Dr Davisson explained. The electron waves are diffracted by crystals and give rise to diffraction patterns which are quite similar to those produced by X-rays. X-ray studies have given much information on matter's structure in the past decade.

The scattering power of atoms is about a million times greater for electron waves than for X-rays. The electron waves will, therefore, give information chiefly regarding the structure of surfaces of crystals, whereas the X-rays give information about the structure of the bodies of crystals. Dr Davisson also expects that the electron waves will allow the study of layers of gas attached to the surfaces of metal crystals.—*Science Service*

ment, however, "the condition known as telangiectasis or X-ray burns," appeared on her neck. Later in 1923, she consulted a physician in New York concerning that condition, and he gave her two radium treatments for it. Because of the telangiectasis, she sued Dr. Hazen in the Supreme Court of the District of Columbia and obtained a judgment for \$15,000. He thereupon appealed to the Court of Appeals of the District.

Miss Mullen conceded that at the time of her treatment Dr. Hazen possessed the degree of skill and ability possessed by physicians of his own class, in Washington, and that the application of roentgen rays was the recognized treatment for tuberculous glands. The only question, therefore, was whether or not Dr. Hazen was negligent, and of this the Court of Appeals could find no evidence in the record. Dr. Hazen testified that he exercised his best judgment in the light of the skill and ability he possessed, and that whether he could have afforded her greater protection by prolonging the periods between the exposures of the same area was entirely and absolutely a matter of individual judgment. "It was a question," said Dr. Hazen, "based largely upon the condition of plaintiff, and I felt that the chances for the grave yard were very, very good, if the treatment were not pushed and the intervals were not made short." Several physicians, qualified as experts in the use of the roentgen rays, testified that telangiectasis "may follow X-ray treatment notwithstanding the fact that the highest degree of skill and care has been exercised in the giving of such treatment," and that there is no known method by which it can be foretold whether telangiectasis will or will not follow such treatment. These witnesses agreed that the treatments administered by Dr. Hazen as shown by the record kept by him, were proper and in accordance with the best knowledge and skill possessed

by men engaged in roentgenology in the District of Columbia at that time. As the Court of Appeals could find no evidence from which it could reasonably be concluded that Dr. Hazen did not exercise his best judgment and ability in treating Miss Mullen, or that in his treatment of her he failed to exercise the care and skill ordinarily possessed and exercised by others in the profession, the judgment of the trial court was reversed with costs, and the cause remanded.

PHYSICIAN EMPLOYED BY PLAINTIFF TO
EXAMINE HIM MAY BE COMPELLED TO
TESTIFY FOR DEFINITE ANT

Webb *et al* vs Francis J. Lewald Coal Co *et al* (Calif.), 297 P R 958

One of the plaintiffs had been examined by a physician, apparently for the purpose of enabling him to testify on behalf of her and her husband in a suit for damages for personal injuries she had sustained. At the trial, however, the plaintiffs did not produce the physician as a witness. The defendants thereupon subpoenaed him. When called to the witness stand, he refused to testify concerning his examination of the plaintiff or his conclusions from it. He contended that after a physician has made an examination for one party to a suit and his conclusions do not support the contentions of that party, and when he therefore has not been produced as a witness by that party, it would be inequitable to compel him to testify in support of the contentions of the adverse party. If it were known that a physician testified under such circumstances, patients would hesitate to come to him for examination and lawyers would hesitate to send their clients to him. The trial court ruled that the witness could not be compelled to testify. Judgment was given for the plaintiffs, and thereupon the defendants appealed to the District Court of Appeal First District, Division 1 California assigning as error,

the position in which the plaintiff was placed for the purpose of demonstrating the roentgen-ray apparatus was such as to permit the roentgen rays to penetrate the abdomen. This testimony, in the judgment of the court, was sufficient to go to the jury for determination as to whether or not the impairment of the plaintiff's vision and the early appearance of her menopause were caused in the manner claimed.

**ADMISSIBILITY OF ROENTGENOGRAMS WHEN
ADMISSION IS NOT PREJUDICIAL**

Consolidated Coach Corporation v's
Saunders (Ky.), 17 S W R
(2d) 233

Where there is no testimony to identify roentgenograms introduced in evidence as roentgenograms of the injured parts of the body that they are supposed to represent, they are inadmissible without the testimony of the person who took them. In the present case, however, two roentgenograms were made of the same injured limb. The second roentgenogram, with the exception of some minor particulars, showed the same character of injury as the first roentgenogram, to the admission of which exception was taken. The physician who took the second roentgenogram testified that his experience enabled him to swear that the roentgenogram to which exception was taken was a roentgenogram of the very same limb that was shown in the second roentgenogram, identified by him. According to this witness the same bones of the human body are differently shaped and constructed in each individual, just as are the faces of such individuals. Moreover, the plaintiff and some of her witnesses testified that the roentgenogram was taken of her limb that the doctor who took it immediately delivered it to her, and that she preserved it. But if such reasons were not sufficient to remove the objections to the introduction of the roentgenogram to the ad-

mission of which exception was taken, its admission could not be considered prejudicially material, since its only purpose was to prove the extent of the plaintiff's injuries, and the testimony was uncontradicted on that issue and no sort of earnest attack was made on the amount of the judgment.

**ROENTGENOTHERAPIST NOT HELD LIABLE
FOR TELANGIECTASIS DUE TO ROENTGEN
RAYS APPLIED FOR TUBERCULOUS
LYMPHADENITIS**

Hazen vs Mullen (Dist of Col.) 32 Fed R.
(2d) 394

The appellee, Miss Mullen, had tuberculous adenitis of the lymph glands on both sides of the neck, running down to the middle of the clavicle and into the armpits. In the absence of treatment one physician testified, the usual result would have been the breaking down of the glands and a long continued discharge through open sinuses, or a rupture of the glands into the blood vessels, with general dissemination of tuberculosis and ultimately death. A surgical operation to remove the glands would have required an incision almost from the ear down to the middle of the clavicle, with the complete cleaning out of everything in the neck on both sides, and in addition to that would have required operations on both armpits. Probably the operation would have extended from the armpits to the clavicle, in order to permit the removal of the intervening glands. While in this condition Miss Mullen consulted Dr Henry H Hazen and was treated by him by the use of roentgen rays from February, 1920, until November of the same year. One side of the neck was exposed every other week. The result was so complete a cure that a medical witness who examined Miss Mullen in 1925 testified that he could not discover any enlarged glands and would not have known that she ever had any tuberculous glands at any time.

Some time after Miss Mullen's last treat-

CASE REPORTS AND NEW DEVICES

X-RAY GENERATOR A WORKING MODEL

By H. A. TUTTLE, Assistant Director, Educational Department, Westinghouse X-ray Co., LONG ISLAND CITY, N.Y.

The first reaction of a student when beginning the study of X-ray technology is

finds himself confronted by phenomena belonging to several electric circuits which are closely related to one another. The reactions occurring within the valve and X-ray tubes must also be considered. And in addition, the problems of rectification must be understood. To complicate the matter, the

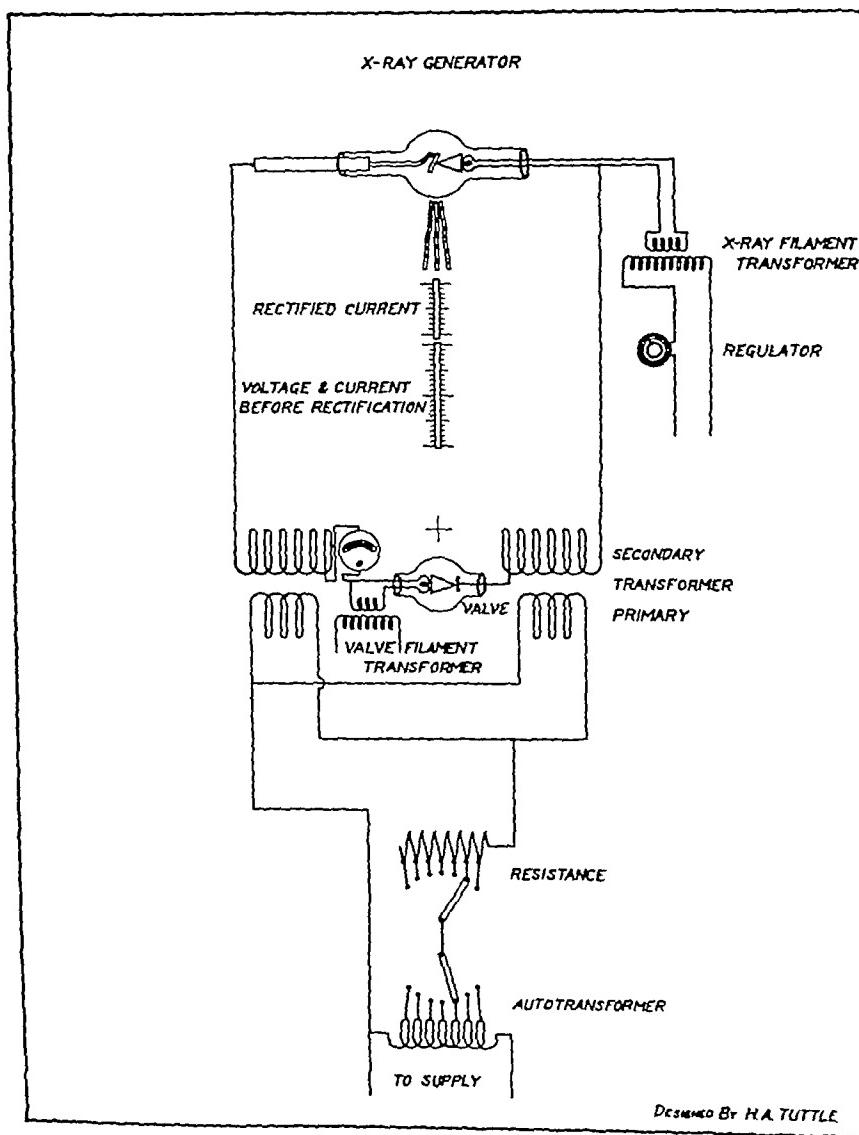


Fig. 1

usually one of bewilderment. This is especially true when he is brought into contact with the X-ray generator. He immediately

progressive, simultaneous changes occurring in all circuits and parts of the apparatus, must be correlated to one another.

among other things, the refusal of the trial court to compel the physician to testify

This ruling of the trial court, said the District Court of Appeal, in reversing the judgment of the trial court, constituted reversible error. However commendable from a professional standpoint may have been the objections of the witness, the policy of the law as declared by the California legislature required him to set aside his scruples and to testify concerning the matters that he had learned from his examination of the plaintiff. When the party examined by him brought suit, she impliedly waived her right to have the results of the examination kept secret, for Section 1881, Subdivision 4, of the California Code of Civil Procedure provides

"A licensed physician or surgeon cannot, without the consent of his patient, be examined in a civil action as to any information acquired in attending the patient, which was necessary to enable him to prescribe or act for the patient, provided, further, that where any person brings an action to recover damages for personal injuries, such action shall be deemed to constitute a consent by the person bringing such action that any physician who has prescribed for or treated said person and whose testimony is material in said action shall testify."

If the ruling of the trial court were correct, said the District Court of Appeal, that the witness could not be compelled to testify unless arrangements were made to compensate him as an expert witness, it would in effect nullify the provision of the law just stated, for then, all a physician need do if he desired to keep off the witness stand would be to demand such compensation for testifying as it would be impracticable for the defendant to pay. That, said the Court, is not the law.

"The authorities, however, all agree that, in the absence of an express contract to pay

a physician for his testimony as an expert, he is only entitled to the statutory fee. The uniform rule seems to be that a physician who has acquired knowledge of a patient or of specific facts in connection with the patient may be called upon to testify to those facts without any compensation other than the ordinary witness receives for attendance upon court. In those States recognizing the right to extra compensation for a physician who testifies as an expert it is uniformly held that, where such testimony is sought to be elicited without requiring any particular investigation on the part of the physician, he is required to testify without extra compensation"—*McClenahan vs Keves*, 188 Calif 574, 583, 206 P R 454, 458

PRIVILEGED COMMUNICATIONS WAIVER BY OFFERING TESTIMONY OF PHYSICIAN

Travelers' Building and Loan Assn vs Hawkins (Ark), 34 S W R (2d) 474

When a party to an action puts his physician on the stand to prove that the party was incompetent to make a certain contract, he thereby waives his statutory privilege of maintaining the secrecy of communications between him and his physician. The adverse party may thereafter cross-examine the physician.

COMPENSATION OF PHYSICIANS LIABILITY OF MEMBER OF FAMILY WHO SUMMONS PHYSICIAN

Benton vs Stadler (Wis), 234 N W R 739

It is a general proposition supported by many authorities that he who orders a physician to come to his home to treat a member of his family becomes responsible for payment for the physician's services unless he makes it known to the physician that he disavows responsibility.

little, if at all, by rectification. Electrons may be seen passing from filament to cathode and, simultaneously, the X-rays leaving the tube. The different curves and markings are so laid out that the phase relationships of all are correct. Note that the electron velocity within the valve is much lower than that through the X-ray tube.

A model can also be constructed to demonstrate the action of a mechanical rectifier. A third part is then necessary. This is shaped to portray the rotor of the rectifier and is placed in front of Figure 1 and is centered to Figure 2. A center bearing is then so arranged that Figures 2 and 3 revolve together. The angular position of the rotor is thereby coupled to the proper value of voltage and current.

This model can be made by a draftsman or photographic copies of all parts can be obtained. These can be mounted on cardboard, and assembled with a simple light bearing. The author used a model 3 feet by 4 feet. A smaller size is perhaps preferable, since it can be examined more easily. A size 12 X 15 inches is easy to handle and is large enough to be very understandable.

The last model which was constructed has been used successfully for over a year. All who have seen it have remarked the easy and thorough understanding obtained by a few minutes' observation.

A MOVABLE FLUOROSCOPE FOR FLUOROSCOPY AND SERIAL RADIOGRAPHY WITHOUT THE USE OF A DARK ROOM

By FRANCIS E TALTY, M.D.,
ARLINGTON, MASSACHUSETTS

In a recent survey of the literature on fluoroscopy made at the Boston Medical Library, Yale Medical Library, and the New York Academy of Medicine, I was amazed to find that little or no attempt has ever been made to do fluoroscopy by any other method

than the dark room. Dr George C Johnson (1), of Pittsburgh, in 1905 wrote an article descriptive of a device whereby he allowed a pyramid of rays to emerge from the tube. The fluoroscope consisted of an ordinary fluoroscopic screen set parallel with the line of vision. He made use of a mirror to reflect a shadow on the fluorescent screen, but his device was a hand fluoroscope, and, as such, was necessarily of limited use and fraught with all the dangers of exposure to the direct rays. Lewis Gregory Cole (2), of New York, in 1913 described a table in which he made use of a mirror, a fluorescent screen, and a stationary dark chamber. The table and dark chamber were placed against a lead-lined partition, back of which was placed a cabinet from which the table was operated. In the article descriptive of this table no mention was made of fluoroscopy outside of a dark room or cabinet. In Dr Cole's device the operator was separated from the patient, which, of course, made it impossible for him to do manual palpation in a gastro-intestinal series, or manual manipulation in case of a fracture. With the Cole table it was necessary to adjust the patient to the screen, rather than the screen to the patient. In other words, Dr Cole's screen was stationary and could be used only from one fixed point on the table, as the rest of the table was lead-lined beneath.

For several months I have been using in my office (a well lighted room), a daylight fluoroscopic device which has given me considerable satisfaction. I am not separated from the patient, can palpate while observing the shadow or can allow the surgeon to manipulate a fracture while observing the shadow. The fluoroscopic screen can be adjusted to the patient rather than the patient to the screen, as my device is beneath the table and can be moved lengthwise and crosswise with respect to the table.

While the series of cases in which I have used this device is a comparatively small

Past experience in instruction proves that charts and mechanical models are of great value to the student. But even with the best of charts, it is difficult, if not impossible, to correctly portray successive continuous changes and to refer the changes in each part of the apparatus to those of every

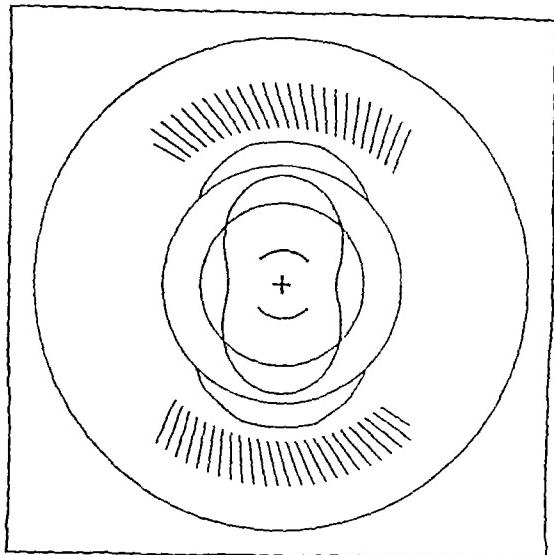


Fig. 2

other. There is only one type of chart or model that will successfully perform this function, and that is the working model.

The working model developed by the author shows first a complete diagram of all of the important electric circuits of an X-ray generator and tube as connected for operation. With a mechanical rectifier a representation of the rotating and stationary parts is given and the electric connections to them are drawn. The model illustrated was constructed for the single valve rectifier and shows the valve in its place in the circuit.

This model is made in two parts¹ (Figs. 1 and 2). The first or main chart (Fig. 1), is best made in rectangular form. It carries a complete wiring diagram of all control apparatus, the high tension transformer and rectifier, and the valve and

X-ray tubes. Several slits are cut in this chart, the use of which will be explained later.

The second part (Fig. 2) is made in the form of a circle. It is so mounted, just behind the main chart, that it can revolve easily. Continuous curves of unrectified and rectified voltages are drawn on its surface in circular form. Near the periphery a succession of dots is drawn which represents electrons. Just within the radius of the electrons is drawn a number of oblique lines. These represent X-rays. Near the center two groups of dots are drawn. These represent electrons passing through the valve.

Near the top of Figure 1, the X-ray tube is shown. Note that a triangular section between filament and target is to be cut out. The electrons drawn on Figure 2 are visible here. Three slits are to be cut in Figure 1 just below the tube and radially to the target as a center. These serve as windows to make the X-radiation, which is drawn on Figure 2, visible. Two vertical slits are to be cut just above the center of Figure 1. The upper of these reveals the curve of rectified current while the lower reveals the sine waves of voltage and current before rectification. A triangular area is also to be cut out of the valve tube as indicated. The electron stream is visible here.

We thus have a working model which indicates the complete circuits, instantaneous values of incoming and rectified voltages, the electron stream of each tube and the generated radiation. Values of these conditions may be easily compared for any phase angle. Or, if a continuous, moving picture of machine operation is desired, Figure 2 may be slowly revolved in a counter-clockwise direction. The student may then see the rising and falling values of incoming voltage through the slit just above the valve tube, and, through the slit directly above that, the changing values of rectified current. The voltage wave is changed very

¹Figures 1 and 2 are not reduced on the same scale.

placed beneath the table with the dark chamber above the table, if such an arrangement was desired.

I have described the device as used in a horizontal position, but it could also be used

chamber until it strikes the floor. The cassette adjustors are then brought together or to the distance of the width of the cassette to be used, and are then locked by turning thumb screws. On a table to the right of the

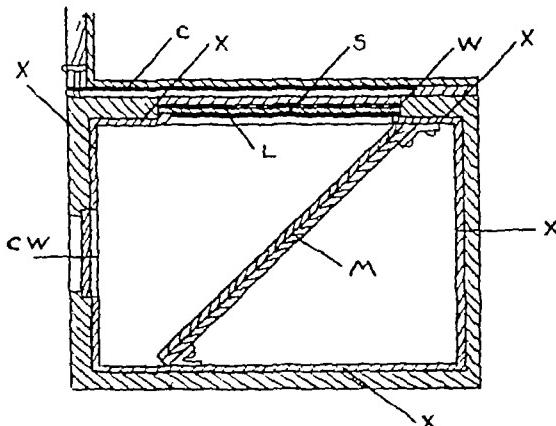


Fig. 2 Side view of dark chamber *W*, wood or plain colored glass cover over screen, *S*, fluorescent screen, *L*, lead glass on which screen is placed, *M*, mirror (angle at which it is placed can be adjusted), *CW*, lead glass chamber window, *C*, opening to insert cassette, *X*, X-ray-proof lining in chamber

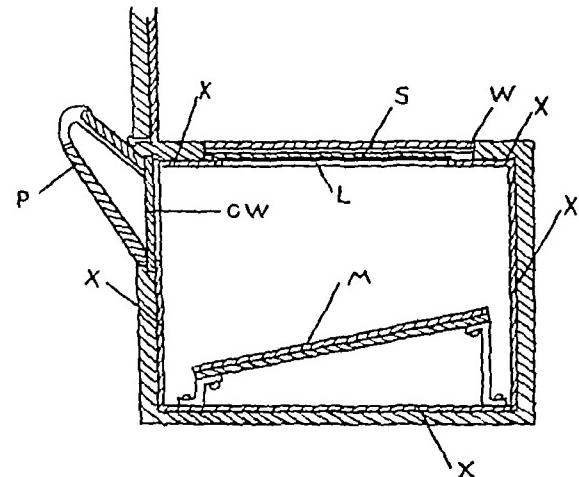


Fig. 3 Side view of dark chamber *P*, periscope attachment, *M*, mirror (at different angle), cassette opening not shown Other letters as in Figure 2

in an upright or angular position by means of counter weights and perpendicular runs

It is, of course, understood that the dark chamber is connected with the tube stand, so that the tube stand and chamber move in unison. For gastro-intestinal and chest work, a device similar to the one shown in Figure 3 could be attached over the lead glass window. Thus, with the ordinary shades of the room drawn, and the use of a red light, eye accommodation could be obtained to enable one to get more detail.

How serial roentgenography is accomplished in this device is illustrated in Figure 4. Briefly explained, the operator sits in front of the dark chamber and locates the area to be roentgenographed. This localized area is then brought to the right side of the chamber and the latter made stationary by pressing down the stop at the bottom of the

operator are placed the desired number of cassettes, each numbered in the order in which it is to be inserted. With the right hand Cassette No 1 is inserted between the cassette holders and the exposure is made. No 2 is next inserted, pushing No 1 to the left side of the chamber, where it is taken by the operator's left hand, or, if a run has been provided, can slide to the floor.

A freely movable lead-lined dark chamber, having a lead-lined panel, as described extending above the chamber and the same so positioned that the patient is between the dark chamber and the tube, is, I believe, insofar as I have been able to ascertain, an original idea.

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one, I feel that it is large enough to justify me in bringing the principle before the roentgenologists I submit a drawing (Fig 1) which will clearly bring out the idea, and will describe it in a brief way

the table and used in connection with a portable X-ray unit, thus making possible a portable fluoroscope for use in homes or wards The front wall of the chamber, lead-lined, is continued above the table, making a panel

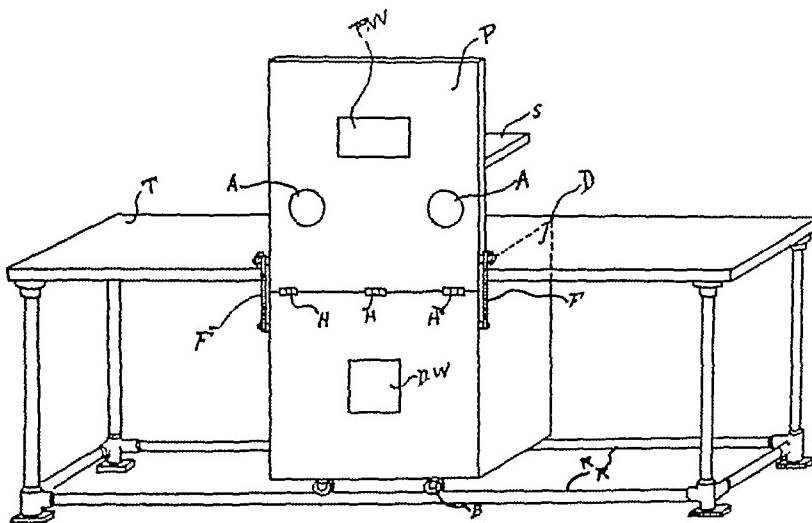


Fig 1 *T*, table top, *P*, X-ray-proof panel above table, *S*, overhanging shelf for supporting lead curtains, *PW*, panel window through which patient on table may be observed, *A*, openings through which arms of operator are thrust, *F*, fasteners for holding panel in upright position, *H*, hinges to allow panel to fold down, *DW*, dark chamber window for observing shadow in dark chamber closed by lead glass, *D*, dark chamber under table, *R*, longitudinal runs placed on transverse runs (not shown in drawing), *B*, ball bearings. The opening for the insertion of the cassette, which must be of aluminum on both sides, is not shown in this drawing, but is seen in Figure 2 (*C*)

Reduced to its simplest terms, this device consists of a freely movable lead-lined dark chamber, having a fluorescent screen placed on lead glass, backed by a colored plain glass or wood, which excludes all light from the chamber, and serves as a roof for the same In the bottom of the chamber is placed a mirror which is capable of being tilted to an angle, and this reflects the shadow from the screen In the side of the cabinet facing the operator is a lead-lined glass window which may be as large as 8×10 for observation of the shadow This dark chamber is placed beneath a wooden table on runs which allow the chamber to be freely moved lengthwise and crosswise with respect to the table If desired, the cabinet can be removed from

which when not in use can be turned down The panel has three openings, the center one closed by a lead glass window for observation of the patient on the table, and one on each side, shut off from the X-ray field by means of a lead curtain, to enable the operator to safely palpate or manipulate the part of the patient under observation

On the overhanging shelf supporting the curtain may be placed a suitable diaphragm to cut down the amount of X-ray energy striking the screen, or this diaphragm could be placed on the roof of the dark chamber and lead curtains attached to the cone, in this way eliminating the overhanging shelf The tube in this device is placed above the table, rather than beneath, but could be



Fig 1. Lateral view, showing the bony fragment in the soft tissues of the foot.



Fig 2. Anteroposterior view, showing the serrated margin of the bony fragment.

amination a bony fragment in the foot. A rather large fragment of bone was demonstrated slightly posterior to the fifth metatarsophalangeal articulation and extending mesially into the plantar tissues. On the original film, the serrated margin of the fish bone is well demonstrated, the density of the

fragment being practically that of the bones of the foot. The fragment was readily removed and the patient returned to his usual duties in ten days.

A TRIPLE BONE LESION¹

By I S TROSTLER, M.D., F.A.C.R., F.A.C.P.,
CHICAGO

In November, 1930, G. M., a rather thick-set Russian man, 42 years of age, was sent to me by a general practitioner for examination of the right hip region. The patient, who walked with a slight limp on the right, was wearing a shoe with the right sole about one inch thick and the heel about one and one-half inches high.

He stated that, since childhood, his right leg had been shorter than the left, but that, until a few months before coming for the present examination, he had had no pain in the joint or hip region. During the four and one-half months preceding the roentgen examination the right hip joint had become progressively stiffer and more painful. When I saw him, he had less than 25 per cent of the normal motion in the joint. Abduction was particularly limited.

There was no history of injury or unusual illness.

A roentgenogram of both hips and the pelvis showed a slight atrophy of the entire right half of the pelvis. The left hip joint,

¹Presented before the Chicago Roentgen Society, Feb 10, 1932



Fig 1. Triple bone lesion.

Table Trans Am Roentgen Ray Sociey, 1908, IX, 274-276.

Idem An X-ray Table for Serial and Stereoscopic Radiography and Fluoroscopy Arch of Roentgen Ray, London, September, 1913, XVIII, 147

While walking about the beach, he kicked at a fish lying there, cutting the right foot. He consulted a physician and was subsequently hospitalized ten days for treatment of the

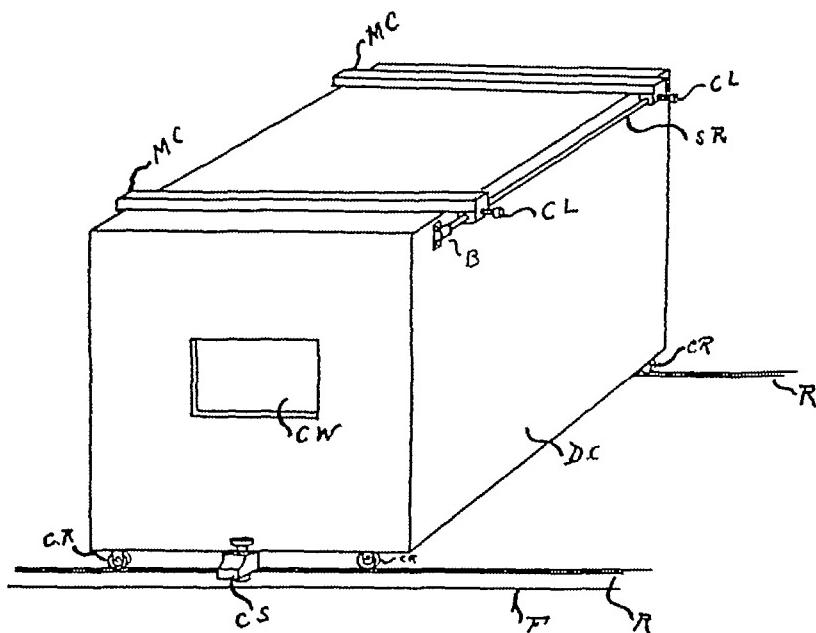


Fig 4. *DC*, dark chamber, *CW*, chamber window, *MC*, movable cassette adjusters, *CL*, screw to lock adjusters, *SR*, stationary run to allow adjusters to slide, *B*, bracket to hold stationary run (back bracket not shown), *R*, longitudinal runs for chamber, *F*, floor of room, *CS*, chamber stop which strikes floor when pushed down, in manner of door stop, *CR*, chamber rollers

THE RADIOGRAPHIC DETECTION OF THE CATFISH SPUR AS A FOREIGN BODY

By W R BROOKSHER, JR., A B, M D,
FORT SMITH, ARKANSAS

The recent case report of Taft,¹ in which a catfish spur was demonstrated in the soft tissues of the foot, prompts the report of a similar case, examined by me in 1923. In my case, the bony fragment is of sufficient size to permit of illustration, it is of further interest due to the period the spur remained in the foot without producing symptoms.

A young man, engaged in spring baseball training at Bradenton, Florida, during March, 1923, was in bathing on March 1

supervening infection. He thought at the time that a fin of the fish had broken off in his foot but no attempt was made to determine its presence. He returned to his usual training duties at the end of the period of hospitalization, experiencing no difficulty with the foot, despite the fact that it was subjected to unusual stress in his pitching.

At the conclusion of the training period, the young man went to the Syracuse, N Y, baseball club where he remained for a period of about ten days, working regularly. To quote his statement, he was "in good form." He was sent to the Fort Smith, Arkansas, club on June 10, 1923. Shortly after his arrival he began to complain of pains in the injured foot. He consulted me and the history of the injury as given suggested the possibility of locating by roentgenologic ex-

¹R B Taft. The Radiographic Detection of the Catfish Spur as a Foreign Body. *Radiology*, January 1932 XVIII 123, 124

slowly disappeared in a way that is said to be characteristic of this condition. With greater and more efficient pulmonary aeration, this doughnut-shaped shadow separated into smaller and smaller areas of more or less circular mottlings as time went on. It was noticed that the part of the atelectatic area closest to the mediastinum was the last to disappear. The area of lessened density in the center of the circular shadow may be accounted for by the fact that a bronchus filled with air seems to enter from the right hilar region to the middle of the atelectatic area.

The diagnosis of congenital atelectasis is made more frequently by the X-ray examination and the symptoms than by the physical findings. In the differential diagnosis among bronchopneumonia, miliary tuberculosis, pulmonary neoplasms, obstructive atelectasis, enlarged thymus, congenital syphilis, and eventration of the abdominal contents into the chest, recourse must be had to the history, symptoms, physical examination, and the clinical course of the condition as well as to the roentgen-ray films, which may have to be taken serially.

Considerable areas of atelectasis escape detection by any means but the X-ray. Films should be taken both during inspiration and expiration, preferably at the end of each phase, to rule out what may appear to be atelectatic areas occurring at the end of expiration. In infancy, expiration is much more complete than in adult life.

The prognosis as regards life depends on how early the diagnosis is made, the underlying cause, the extent of the atelectasis, the time of the institution of treatment, and the type of the treatment. Recent developments lend strong support to the frequent occurrence of pneumonia in cases of atelectasis (1).

It is good prophylaxis for as many in-



Fig 1 Doughnut-shaped shadow in the right pulmonary field of an infant chest interpreted as due to congenital atelectasis



Fig 2 Same case, five days after birth. Barium in the stomach and the proximal small bowel to indicate their normal position. This film shows more clearly the air-containing branch bronchus which enters the central clear area of the doughnut-shaped density.

left acetabulum, and upper fourth of the left femur were normal. The right hip joint showed erosion or absorption of the cartilage of the joint surfaces. The space between the head of the femur and the acetabulum was reduced and decidedly at variance with the normal. There was an osseous extension outward from the upper outer border of this acetabulum. The right acetabulum was wider and rougher on its inner articular aspect than is normal and did not present the normal smooth outline. The head of the right femur presented a mushroomed outline, with shortening of the femoral neck and reduction of the density of the head, neck, and both trochanters. The femur was abducted and Shenton's line destroyed.

In the intertrochanteric region, an oblong or oval area of rarefaction, with a denser border or edge, was seen. This, to all appearances, was the remains of an abscess of the bone. Below this area (in the upper third), the shaft of this bone appeared to be normal.

SUMMARY

Summarizing the above findings, it is my opinion that—

1 There was Perthes' disease in early childhood,

2 There was a Brodie's abscess in the intertrochanteric region of the right femur,

3 There was at the time of the roentgenographic examination, an infectious arthritis in the right hip joint, with an effort at fixation, resulting in abduction for the purpose of lessening the tension within the joint.

CONGENITAL ATELECTASIS DISCUSSION AND CASE PRESENTATION

By M BRAVERMAN, M.D., and
S BROWN, M.D.

From the Department of Roentgenology, Jewish Hospital, CINCINNATI, OHIO

It frequently occurs that the persistence of the fetal pulmonary state, which is physi-

ological to a limited degree during the first few days of life, can be diagnosed only with the roentgen ray, due to a lack of symptoms or signs. The condition may be either partial or complete, unilateral or bilateral.

Congenital atelectasis occurs more frequently in premature and feeble babies. Other causes are birth injury to the central nervous system, narcotization, inhaled meconium or amniotic fluid, and prolonged or difficult labor.

Atelectasis most often involves the paravertebral and central portions of the lungs, especially the areas close to the hilus. The expanded areas are seen at the periphery. This is undoubtedly due to the fact that the periphery of the lung is the most mobile.

Considerable degrees of atelectasis may be found at necropsy in an infant who, in life, presented few or no symptoms. Examination of the chest may present nothing definite except poor resonance throughout. Auscultation may sometimes reveal medium coarse râles or, more often, fine crackles or showers of fine crackles, especially when the infant is made to breathe deeply.

Recently it was our privilege, through the kindness of Dr L Friedman, to study the chest of an infant, Baby D, who was born of healthy parents at the Jewish Hospital November 18, 1930. A moderate degree of cyanosis was present for the first twelve hours following a prolonged and difficult delivery by version of a breech. The child, twenty-four hours post-delivery and presenting no symptoms or signs, was found to have a doughnut-shaped shadow (Figs 1 and 2) in the right pulmonary field close to the heart on an anteroposterior view and overlying it on a lateral view. During the period of about four months, when the gradual disappearance of this shadow could be watched by serial X-rays, the child did not present any symptoms or physical signs. This singular roentgen-ray finding, interpreted by us as congenital atelectasis, has

sclerosis around the margin of the described lesion (Fig 1) A tentative diagnosis of bone abscess or bone cyst was made On March 3, 1931, the patient was operated upon through a lateral incision The cortical bone covering the site of the cavity seen in the roentgenogram was removed with a chisel The surrounding bone was hard, and the cavity was filled with a gelatinous material, slightly pearly gray in color This material had broken through the cortex on the plantar surface, but there was no invasion of the soft tissue The material was curetted out and a specimen sent to the laboratory for diagnosis The hard sclerotic bone was cut away to leave no over-hanging edges and the wound was closed (Fig 2)

The microscopic examination revealed several types of growth (Fig 3) Numerous areas were composed of perivascular endothelial cells, occasionally multinucleated giant cells were seen There was also imperfectly formed cartilage All of the sections examined approached, in certain areas, the picture of a myxosarcoma While the histologic appearance suggested a rather slow-growing tumor of a low grade of malignancy, it was nevertheless an osteogenic sarcoma The diagnosis was chondromyxosarcoma

Forty-eight hours after the operation X-ray deep therapy was started in prefer-

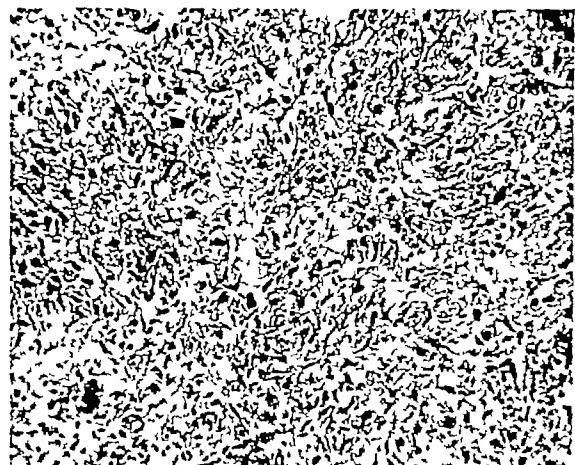


Fig 3 Photomicrograph of removed tissue (100 diameters)

ence to radical surgery From March 5 to April 10, 1931, a total of 1200 r (surface dose) was applied over the incision, using a field of 6.5×6.5 sq cm, 50 cm FSD, and an effective wave length (Duane) of 0.16 Ångstrom unit The changes in the bone at the site of the former lesion are well demonstrated in Figures 4 and 5 The last roentgenogram (Nov 16, 1931) revealed a circumscribed area in the os calcis, slightly less dense than the surrounding bone The sclerosis around the margin, as described at the first examination, was still present It was noted, however, that the bone structure was apparently nearly homogeneous It may also be mentioned here

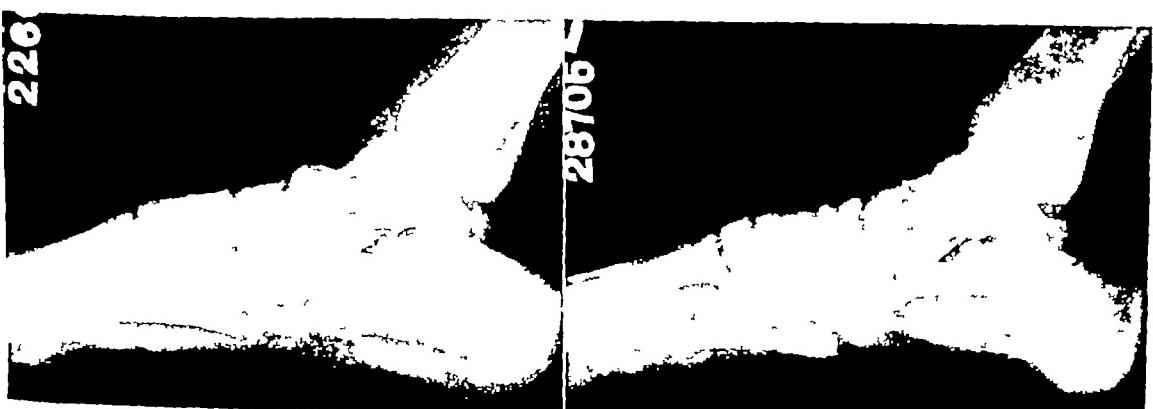


Fig 4 Left foot, April 11, 1931

Fig 5 Left foot, Nov 16, 1931

fants as possible to have a ten-minute inhalation of a mixture of carbon dioxide and oxygen at least three times a day during the first few days of life as a measure against atelectasis and pneumonia (2)

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CHONDROMYXOSARCOMA OF THE OS CALCIS

By ERNST A. POHLE, M.D., PH.D., and WILLIAM D. STOVALL, M.D., University of Wisconsin Medical School, MADISON, Wisconsin

On Feb 25, 1931, S.Y., white, female, aged 12 years, was admitted to the orthopedic service, University Hospital, with the complaint of pain in the left heel. She had not been able to use it in walking for the two weeks preceding her admission to the

hospital. The diagnosis of the referring physician was osteomyelitis.

It appeared that, in January, 1930, she had slipped on ice and hurt her left foot, the skin, however, was not broken. The parents thought she had a sprained ankle and applied hot dressings. She continued to walk, using her heel as little as possible. In September, 1930, the pain increased and the heel became slightly swollen. Cold seemed to aggravate the pain. In January, 1931, a physician was consulted, roentgenograms were taken, and a diagnosis of osteomyelitis made.

The general physical examination was essentially negative. The temperature varied between 97.8° and 100° Fahrenheit. There was swelling, with tenderness at the lateral aspect of the left heel but no limitation in motion and the patient walked normally. The roentgenograms of the foot, taken on Feb 25, 1931, showed a sharply circumscribed, circular, punched-out area about 1.5 cm in diameter on the medial margin of the plantar surface of the os calcis. This had broken through the cortex. There seemed to be no bone atrophy but moderate



Fig 1 Left foot, Feb 26, 1931

Fig 2 Left foot, March 5, 1931, two days following operation

sclerosis around the margin of the described lesion (Fig 1) A tentative diagnosis of bone abscess or bone cyst was made On March 3, 1931, the patient was operated upon through a lateral incision The cortical bone covering the site of the cavity seen in the roentgenogram was removed with a chisel The surrounding bone was hard, and the cavity was filled with a gelatinous material, slightly pearly gray in color This material had broken through the cortex on the plantar surface, but there was no invasion of the soft tissue The material was curetted out and a specimen sent to the laboratory for diagnosis The hard sclerotic bone was cut away to leave no over-hanging edges and the wound was closed (Fig 2)

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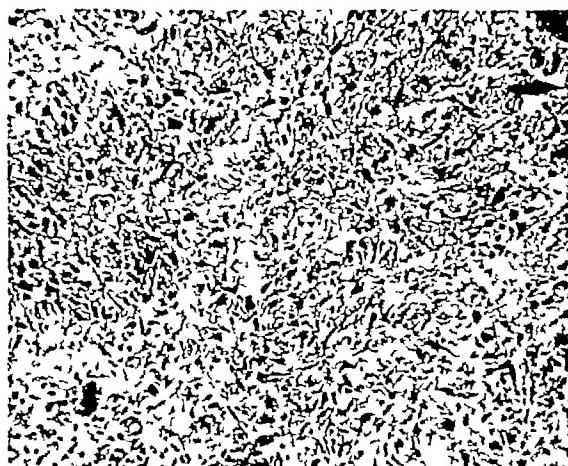


Fig 3 Photomicrograph of removed tissue (100 diameters)

ence to radical surgery From March 5 to April 10 1931, a total of 1200 r (surface dose) was applied over the incision, using a field of 6.5×6.5 sq cm, 50 cm F S D, and an effective wave length (Duane) of 0.16 Ångstrom unit The changes in the bone at the site of the former lesion are well demonstrated in Figures 4 and 5 The last roentgenogram (Nov 16, 1931) revealed a circumscribed area in the os calcis, slightly less dense than the surrounding bone The sclerosis around the margin, as described at the first examination, was still present It was noted, however, that the bone structure was apparently nearly homogeneous It may also be mentioned here



that X-ray therapy did not interfere with the healing of the incision

The patient is now enjoying good health and can walk freely. Roentgen examination of the chest has failed to show any abnormalities. This patient is returning once a month for re-examination.¹

We have reported this case for two reasons. In the first place it is interesting from the diagnostic standpoint because it demonstrates the difficulties encountered in such cases, and, secondly, because we feel that X-ray deep therapy has been of definite benefit in clearing up the local lesion.

A CASE OF CARCINOMA OF THE THYMUS

By J. J. COLLINS, M.D., Radiologist, the John D. Archbold Memorial Hospital, THOMASVILLE, GEORGIA

A case of thymic tumor is reported in which the clinical diagnosis was cellulitis of the neck, with sinus thrombosis, the roentgen diagnosis was abscess or tumor of the upper mediastinum, and the pathologic diagnosis, made postmortem, was carcinoma of the thymus, with metastases to the lungs, liver, and mesenteric lymph glands.

Anamnesis.—The patient, colored, male, aged 28, was admitted to the John D. Archbold Memorial Hospital on Aug. 25, 1930, and died on Aug. 28, 1930. The past history was unimportant. The present illness began five weeks previous to admission with sore throat, toothache, fever, and general malaise. Several days later swelling of the neck was noted which soon became progressively more marked. Edema of the eyelids appeared and later marked difficulty in breathing and swallowing was noted. For three or four days previous to admission nothing could be swallowed except small amounts of fluid.

Physical Examination.—Temperature 101 degrees F., pulse 120, respiration 30. The patient was a well-nourished, well-de-

veloped colored male. Respiration was labored, the neck markedly swollen, the face and eyelids edematous, and there was a bilateral exophthalmos.

The swelling of the neck was uniformly hard and smooth, nothing suggesting enlarged glands in this or any other area was found. No dilatation or prominence of the superficial vessels was discernible. A bloody mucus discharge exuded from the mouth and nose. There were coarse râles and exaggerated breath sounds throughout both lungs. There was a wide area of dullness over the upper mediastinum. No edema of the arms or thorax was noted.

Laboratory Findings.—White blood cells, 9,150, polymorphonuclear leukocytes, 80 per cent, eosinophiles, 2 per cent, transitional cells, 4 per cent, lymphocytes, 14 per cent. Red blood cells, 3,350,000. Hemoglobin, 60 per cent. The blood sugar and non-protein nitrogen were within normal limits. The urine, which contained a few granular casts, had a specific gravity of 1.035. The Kahn test was negative.

Roentgen Report.—Examination of the chest was made August 26, 1930. A single film only was made because of the semicomatose condition of the patient. There was a large dense mass, 11 cm in width, in the upper mediastinal area, extending laterally on both sides beyond the mediastinum. The upper border extended above the sternoclavicular articulations and the lower border fused with the heart shadow. The lateral borders were well defined and regular. There was definitely a diminished aeration of the upper lobe of the right lung but no other evidence of pathology. Considering the history and course of the illness it was thought that the condition was mediastinal abscess rather than tumor.

The patient died on his fourth day in the hospital. The salient points of the postmortem examination were: The neck was markedly swollen and the face and eyelids edematous. There was a marked bilateral

¹In April 1932 the patient was still well.

exophthalmos. None of the superficial glands was palpable. The pericardial and pleural cavities contained no increased amount of fluid. A large mass, shaped like an inverted pyramid, filled the upper mediastinum. This was of grayish color and cartilaginous consistency. There was no infiltration of the lungs, sternum, or surrounding structures, but there was a very definite compression of the lungs, trachea, and vessels of the mediastinum. No thrombi or erosions were found in any of the vessels. The pleural surfaces of the lungs showed numerous small, avascular, grayish nodules. The liver contained multiple small, grayish, necrotic areas. Cultures from these were sterile. In the abdominal cavity there were three enlarged mesenteric glands. No pathology was found in the brain.

Sections from the tumor and metastatic areas were examined by Mary J. Erickson, M.D., and a diagnosis of an undifferentiated cell carcinoma was made. Sections were submitted to the late Dr. Warthin whose report was as follows:

The greater part of this neoplasm is necrotic. The living areas present the appearance of an undifferentiated cell carcinoma, very medullary in areas. It may be a so-called thymoma of carcinomatous type. It is distinctly epithelial in type and not lymphoblastic.

In 1930, Doub (1), in reviewing the literature of thymic tumors, found that approximately a hundred cases of all types had been reported. To this number may be added five other cases reported by him. Of these cases of thymic tumor approximately 20 were carcinomas, the remainder being for the most part sarcomas.

Brannan (2), in 1926, reviewing the literature of carcinoma of the thymus, stated



Fig. 1 Upper mediastinal tumor with clear-cut borders. There is no evidence of invasion.

that 19 authentic cases had been reported. This number included a case reported by him and one by Foot in that year.

The case of carcinoma of the thymus here reported is one which did not present the usual local invasion of surrounding structures but did present the pyramidal form and the compression of the vessels of the mediastinum described by Brannan. Metastases to pleura, liver, and mesenteric glands had also occurred. The course of the disease, following the initial symptoms, progressed rapidly to a fatal termination. There were no palpable glandular enlargements to suggest the diagnosis of tumor or to afford biopsy specimens.

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EDITORIAL

LEON J. MENVILLE, MD
BUNDI ALLEN, MD

Editor
Associate Editor

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Radiological Society of North America*

OBJECTIVES IN RADIOLOGY¹

Radiology, the newest member of the medical family, is still experiencing the growing pains incidental to reaching a useful maturity. Most of us have watched its development from the time of the old static machine, which, if it was capable of impressing faintly the bones of the hand on a photographic plate, was considered a wonderful thing. With the development of increased power through the use of larger induction coils and the introduction of the transformer came the realization, and sadly so, to many of the pioneers, that somehow these rays had a decided effect on tissue cells. This, in turn, led to further study to determine to what extent these rays might be used to affect tissue cells deliberately, particularly in the various malignant diseases. The introduction of the Coolidge tube and further refinements in apparatus, such as the movable grid, double intensifying screens, and films of greater speed, led finally to diagnostic endeavor to interpret pathology in the soft tissues as presented by the use of contrast media of various kinds for outlining the gastro-intestinal tract, visualizing the gall bladder, the kidney pelvis, ureters, and bladder, and tracing the outlines of cavities and sinuses. All of this within a period of three and a half decades! Is it any wonder

that the application of radiology should to-day find itself in a more or less chaotic situation? On the one hand we have the few sincere men striving to place radiology where it belongs, on the other we have the multitude trying to make interest charges on equipment sold to them by enterprising salesmen. In the first instance the object is humanitarian and scientific, in the second, purely economic.

What is the greatest objective in radiology? Service. Service to hospitals, service to their staffs, and, most important of all, intelligent service to the patient, who, in this case, is the ultimate consumer. The patient is entitled to the best service and opinion possible at all times and I am happy to say that, for the most part, he is getting them; else applied radiology would soon pass into disrepute.

The larger hospitals throughout the country, practically without exception, employ full-time directors for their X-ray departments. But what about the bulwark of the Nation's health defense, the hundreds of smaller hospitals that cannot afford to employ full-time directors? We cannot expect a small hospital to operate its X-ray department at a financial loss, neither should any hospital expect income from its X-ray department to offset losses from elsewhere within the institution. The reputation for thoroughness which a hospital might acquire through an efficient X-ray department, and the additional number of patients who might, for that reason, use the hospital should be a full reward. Apparently, then, the only solution for adequate service within the means of the small hospital, for the present at least, lies in some sort of part-time arrangement with a competent and recognized roentgenologist.

¹Read before the Radiological Society of North America at the Seventeenth Annual Meeting at St. Louis, Nov. 30-Dec. 4, 1931

In an effort to determine the value of a roentgenologist to a small hospital, and to evaluate this in tangible terms, a 65-bed hospital was chosen. Prior to the early part of 1930, the procedure in the hospital² selected for this study was quite similar to that of many others of approximately the same size. That is, the hospital employed a technician and the referring physician interpreted the film. All of the X-ray records and films from 1925 to January 1, 1931, were carefully examined in order to contrast the work done before a part-time roentgenologist was employed with the work done after this arrangement had been made. The outstanding features of this survey will follow, and I might add that the roentgenologic supervision in this hospital is that of another than myself, and, therefore, the conclusions drawn are unbiased.

The equipment, which was installed new in 1925, is capable of doing as high-grade work as can be done anywhere. It is still in use, so no corrections need be made for change of equipment.

The following comments will give a general idea of the character of work done in this hospital in 1925 and 1926. Radiographs of bony structures, including lumbar and dorsal spines, were uniformly good. However, no lateral projections of the spine were found. Stereoscopic views were limited to the skull and, in a few instances, to the pelvis, and did not include any of the smaller regions, for example, the shoulders. Films falling into the gastro-intestinal classification contained a few flat films of the abdomen. In cases in which contrast media were used the films were limited for the most part to one or two, all being taken in the standing position. Films of the gall-bladder region were all without contrast media, in only one case could the gall bladder be visualized. Kidney films in general were unsatisfactory as far as being informative

was concerned. Only one case had had retrograde pyelography and in that only the ureter was visualized. Chest films were satisfactory throughout except that they were not taken stereoscopically.

In 1927, films of the gastro-intestinal tract showed some improvement in that a greater number of films were used in each case and the contrast meal was followed into the colon. Several of these examinations were made in the horizontal position with, of course, increased detail and interpretative possibilities. Some of the gall-bladder examinations during this year were made with oral dye in capsule form, frequently the capsules in the colon were more prominent than the object of their use.

The years 1928 and 1929 continued to show improvement, especially in gastro-intestinal work. Gall-bladder films were capable of more conclusive interpretation and films of this region following intravenous dye were found. Chest films were more often taken stereoscopically. In all of these years, films of the opposite extremity or side for comparison in checking a doubtful finding or a congenital anomaly were conspicuously absent. A few interesting films were found but no effort had been made to take additional films in other positions or to follow them up with subsequent exposures. What a wealth of interesting material must lie buried in the hospital files of the country! No written reports accompany any of the cases examined during these years except that in one or two instances the individual physician may have referred the films to a roentgenologist for some special reason of his own. Taking into consideration that there was no one to make suggestions for proper procedure the work done was very satisfactory as far as it went and no criticism is intended.

Early in 1930, a roentgenologist was employed to supervise the X-ray Department and to visit the hospital one day a week.

²Community Hospital H. H. Windsor Memorial X-ray Laboratory, Geneva, Ill.

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The larger hospitals throughout the country, practically without exception, employ full-time directors for their X-ray departments. But what about the bulwark of the Nation's health defense, the hundreds of smaller hospitals that cannot afford to employ full-time directors? We cannot expect a small hospital to operate its X-ray department at a financial loss, neither should any hospital expect income from its X-ray department to offset losses from elsewhere within the institution. The reputation for thoroughness which a hospital might acquire through an efficient X-ray department, and the additional number of patients who might for that reason, use the hospital should be a full reward. Apparently, then, the only solution for adequate service within the means of the small hospital, for the present at least, lies in some sort of part-time arrangement with a competent and recognized roentgenologist.

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"radiographic study", perhaps the latter is better. Films are only a means to an opinion and in the final analysis the opinion is the entity for which the patient pays.

Another important objective should be to make yourselves consultants in every sense of the word. For the most part a roentgenologist seems content to sit at the viewing box and report what he sees in the shadows. Would it not be better to be seen more often at the bedside of the patient? It will give the patient a good impression and he will feel that everything possible is being done, it will be helpful to the attending physician, suggestions to him of another angle from which to attack his problem will often be appreciated. In this way the roentgenologist can order the exposures necessary for the best results instead of accepting whatever projections the attending man may think necessary. In any event, insist on a history of all obscure or doubtful cases, or at least a synopsis of the outstanding objective and subjective symptoms. Patients are glad to have X-ray examinations made, they are comprehensible to them and, therefore, received by them with confidence. See to it that the character of your work continues to merit this confidence.

What of the future? Forecasts are always hazardous but interesting. Could anyone have predicted twenty years ago what the present gives in all the branches of radiology and to what extent radiology is being used to-day in the fields of diagnosis and therapy? A few years ago, surgery was the only accepted method of treatment in malignant conditions, to-day irradiation shares equally with surgery in importance. Perhaps the future, through better facilities and better technic in application, will find irradiation the only accepted method of treating cancer. Who knows? There will be less surgery done in the next decade, everything else being equal, for, as refinements in apparatus and methods are perfected, roent-

genologists will keep pace with increased skill in interpretation. The net result will be less necessity for undertaking surgical procedures on an exploratory basis. Irradiation is already displacing surgery in the treatment of some cancerous conditions, notably in the female pelvis and in malignancies about the tongue, mouth, and face. Eradication of cancer is a gargantuan task, neither the surgeon nor the radiologist can afford to ignore the other, and each must have implicit confidence in the pathologist. With the establishment of cancer clinics throughout the country, under responsible guidance, the future holds much hope. In this work as in all of the problems of the future, radiology can be depended upon to contribute its full share in an ever increasing sphere of usefulness.

H T MOSTROM, M D

Batavia, Illinois

COMMUNICATIONS

FLORIDA RADIOLOGICAL SOCIETY

The regular annual meeting of the Florida Radiological Society was held in Sarasota, Florida, on May 2, 1932, at the Sarasota Terrace Hotel. Lester W Cunningham, M D, of Jacksonville, President of the Society, presided. Informal presentations of case reports and demonstrations of interesting roentgenograms were featured at the morning and afternoon sessions.

The following officers were elected, to serve until the spring meeting, 1933. *President*, Orion O Feaster, M D, St Anthony's Hospital, St Petersburg, Florida; *Vice-president*, Frederick K Herpel, M D, Good Samaritan Hospital, West Palm Beach, Florida; *Secretary-Treasurer*, W McL Shaw, M D, 418 St James Bldg, Jacksonville, Florida.

He is still retained in this capacity. It is interesting to report that this hospital was approved as a fully standardized hospital at the fall meeting of the American College of Surgeons. It must follow, therefore, that a part-time service of the proper kind is satisfactory. A comparison of the films and the general management of the department for 1930 with those of the preceding years should show some differences.

In the first place, each case carries with it a written report of the shadow features presented in the films, over the signature of the roentgenologist in charge. Secondly, fluoroscopic procedures have a more definite value. Thirdly, the number of cases of soft-tissue examinations, such as kidney and gall bladder, have increased in number, the latter 100 per cent over the preceding year. Fourthly, films of the opposite side for comparison are almost a matter of routine. Fifthly, the X-ray findings and interpretations are accepted with more confidence by the members of the staff. And, lastly, opportunity is had for proper therapeutic procedures.

Let us now look at the situation from the financial side. The gross income from this X-ray Department in 1925 was \$1,286.50. This amount was a little more than doubled in 1926, due principally to the fact that 1925 was only an eight-month year in this department. The gain each year following was irregularly upward but only at a rate of two or three hundred dollars each year. The gross income for 1929 was \$3,033.50, approximately \$100 less than in 1928. For the year 1930, when roentgenologic service was had for the last ten months, the gross income was \$4,583.00, an increase of 50 per cent. In the present year, 1931, the gross income to October 1 is \$3,507.00, not a bad showing in this period of world-wide mental depression. This does not mean that the hospital is any better off financially so far as its X-ray Department is concerned. In fact, its net income is less

than in the period prior to 1930, but it is rendering a better service to its patients and a better service to its staff. After all, that is the ultimate function of any hospital, and no hospital management should feel that it can afford not to provide the best in its radiology department.

The exact nature of the financial arrangement between the hospital and the radiologist is immaterial so long as the relationship is harmonious and neither one feels that the other is getting the better of it. No arrangement can be satisfactory under which the cost of an X-ray examination to the hospital is in the balance. Then only the most obvious conditions will call for a radiologic examination, and other cases in which this examination is of more importance and the indications less obvious will not receive the full benefit of their hospital stay. Probably a straight salary on a part-time basis, adjusted from time to time on the value of the work done, is conducive to the best general results and will lead ultimately to a larger volume of work than an arrangement under which the cost is considered each time.

Patients are human and have the traits with which Nature endowed them. I refer particularly to that of possession. The question of ownership of films is quite generally conceded to lie with the individual or hospital making the exposures, but a film is something tangible and understandable to a degree by the patient. Therefore, it is not surprising that he should feel that he has an interest in the film and that it should be available to him in shopping around a bit. Imagine a patient going from doctor to doctor with a ureameter in one hand and a sedimentation glass in the other. It is all a matter of education and roentgenologists, themselves, are largely to blame for this situation. How often do we not hear, "We'll take a film of this and see what you have." Make it one of your objectives to dignify your profession. Always refer to this kind of work as an "X-ray examination," or a

"radiographic study", perhaps the latter is better. Films are only a means to an opinion and in the final analysis the opinion is the entity for which the patient pays.

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Tours to Russia—Conrad K. Gale, M.D., 225 West 86th St., New York City, has asked RADIOLOGY to announce that an invitation has been extended to American physicians and surgeons by the medical associations of Leningrad, Moscow, and other cities of Soviet Russia, to visit their hospitals, clinics, research laboratories and similar institutions.

This is the first occasion ever offered the American physicians to inspect officially these most interesting phases of Russian medical life.

The group of American physicians, which is now forming, will sail this summer. Those interested can get full information from Compass Tours, 55 West 42nd Street, New York City.

Our attention has been called to a paper by I. S. Trostler, M.D. in the April, 1932, issue of the *Illinois Medical Journal*, page 343. The title is "The Commercial Roentgen Laboratory—Some Good Reasons why they should not be Tolerated or Patronized," and such of our readers as are interested in this timely—in this country, at least—question may read the paper with interest.

BOOK REVIEWS

UNITED STATES ARMY X-RAY MANUAL Authorized by the Surgeon-General of the Army. Second Edition, rewritten and edited by Lt. Col. H. C. PILLSBURY, M.C., U.S.A. Pages 482, with 228 illustrations, 12 mo, flexible leatherette. Published by Paul B. Hoeber, Inc., New York, 1932. Price, \$5.00.

This book has been sufficiently modified from the Manual intended primarily for the student of military medicine to permit it now to be classed as a suitable text-book for the instruction of medical students anywhere. There are still a few pages devoted to military matters, but, after all, there is no strict difference between the practice of roentgen-

ology in military and in civil life. The problems of physics and of diagnostic internal medicine, of fractures and bone tumors are common to civil and military life. No space has been given to therapy. The text is carefully prepared. The illustrations are numerous and well chosen, and the book is a commendable introductory work for those who wish to take up the study of roentgenology.

JAMES T. CASE, M.D.

SURGICAL PATHOLOGY OF THE GENITO-URINARY ORGANS By ARTHUR E. HERTZLER, M.D., Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kansas, Professor of Surgery, University of Kansas. A volume of 286 pages and 222 illustrations. Published by J. B. Lippincott Co., Philadelphia, 1931. Price, \$5.00.

This monograph is one of a series of monographs which Dr. Hertzler is writing on surgical pathology. The subject matter of this volume is disposed of in three parts, namely, diseases of the external genitalia in the male, diseases of the prostate and the bladder, and diseases of the kidney and ureter. The descriptive nature of the discussions and the excellent illustrations of gross specimens and the photomicrographs hold the reader's interest from the beginning to the end. The bibliographies, one at the end of each chapter, denote a critical review of the subject and add much to the value of the book as a reference volume.

The author has successfully and efficiently performed his task of presenting the subject from the viewpoint of the general surgeon, freed as much as possible from the complications of the specialists. Rarely does one encounter pathologic descriptions and classification of tumors so simplified. The emphasis which he has placed on the similarity of the embryonal tumors as found in the testicle and kidney is commendable.

For tumors of the testicle he has adopted the classification proposed by Hinman because it clarifies the subject for the surgeon. This includes seminomas and embryomas. The seminomas are so named because the cells are

made up pretty much of one type, frequently lobulated, especially in the less malignant ones. He states it is the most common testicular tumor and is distinctly one of adult life. Those of this group which seem to develop from seminiferous tubules, he feels, are merely those which least deviate from the normal. These tumors metastasize early, and usually before the primary tumor is noted have already extended to the lungs, retroperitoneal and supraclavicular nodes. The prognosis has been much improved with the advent of the X-ray, since the cells of this group are radiosensitive. Embryomas (teratomas) from the other group are composed of more maturely formed tissues, such as cartilage, muscle, glandular structures, etc. He regards a tissue which is a *biologic impossibility* as originating from a teratoma of the testicle.

Disease of the prostate is considered under three general heads: its inflammations, its hypertrophies, and its malignancies. The importance of accurate evaluation of all the factors influencing prostatic obstruction is stressed, since not infrequently the prostate is accused of producing symptoms totally unrelated to it. The secondary results of enlarged prostates such as hypertrophied bladder wall, the formation of cellules and diverticula, the cystitis incident to catheterization, and, finally, pyelonephritis are well described. A pathologic explanation of the causes of failure after prostatectomy, aside from a wrong diagnosis, is stone formation. The author feels this is more common when the prostatic bed is packed with gauze to control bleeding, and that a blood clot furnishes excellent nuclei for the formation of stones. The failure to remove enough capsule and excessive scar formation in the prostatic bed are noted. In dealing with carcinoma of the prostate the reader's attention is directed to the characteristic hard and nodular feeling of the gland which is the earliest and most reliable of all signs of malignancy. The pathogenesis and the pathology are logically reviewed.

The two types of papillomas of the bladder, the villous which he considers more or less benign, and the broad-based, usually malignant, are considered separately. He states that

the points of differentiation are in the arrangement of the villi and epithelium of the stalk, and the surgical pathologist should not offer an opinion as to its identity without an examination of the stalk. Epitheliomas and sarcoma of the bladder are considered separately also.

The chapter on urolithiasis covers this subject in an excellent manner. The author has gone into the etiology of calculi, with many remarks regarding their distinctive characters. The photographs of the various types of stones and the secondary changes produced in the bladder, ureters, and kidneys are excellent. Infections of the kidney are divided in the primary and secondary groups under the primary infections of the kidney. Brewer's kidney is discussed at great length. Brewer's kidney represents an acute lesion due to embolism from regions elsewhere in the body which produce infarcts, with resultant intense reactions of the entire body. Some of these are sufficiently infectious to produce abscesses, but the author feels that a great majority of these subsides spontaneously, due to some bactericidal factor in the kidney similar to that known to be present in the liver. He presents photographs of kidneys showing the resultant scars of these infarcts which have undoubtedly occurred a matter of years before the kidney was sufficiently involved to require surgical removal.

Essential hematuria is regarded as due to an unlocalized focal renal infection. Secondary infections of the kidney such as result from stones, prostatic obstruction, tumors, etc., are regarded as ascending infections and caused by the colon bacillus. The author agrees with Burns and Swartz on this point.

In dealing with tuberculosis of the kidney the author points out that the kidney, next to the lung, is the commonest site of tuberculosis, and that, on account of the accessibility of the kidney to the surgeon, there has been too much tendency on his part to regard kidney tuberculosis from the operative standpoint only. Careful differentiation between the acute and chronic forms of tuberculosis is discussed. The lesions of chronic tuberculosis of the kidney are divided into four groups:

(1) tuberculous ulceration of the apices of the pyramids, (2) chronic disseminated tuberculosis, (3) cheesy-cavernous forms, (4) mixed infections

Under cystic disease of the kidney are grouped together such conditions as solitary cysts, cysts associated with chronic nephritis, congenital polycystic disease, a number of very rare cysts and hydronephrosis. Hydronephrosis was placed in this group merely as a matter of convenience to him for its discussion. The various theories underlying polycystic disease of the kidney are briefly but carefully reviewed.

The author presents an admirable classification for tumors of the kidney. This classification includes the more common tumors, while those which are considered rare are grouped separately and are referred to principally in the bibliography. The classification of the more common tumors of the kidney is First, adenocarcinomas which are derived from the kidney tubules, remaining more or less spherical but gradually invading the surrounding kidney tissue, second, hypernephromas (fetal adenomas). This latter is the commonest group of kidney tumors. The author objects to having these tumors designated as carcinomas, since there is nothing in their structure or life history to suggest a confusion with carcinomas. The third group in the classification includes teratomas of infancy and childhood—the embryonal tumors of the kidney usually designated as sarcomas. These are characterized by their diversified cell structure, the author stating that the variety of cell structure and arrangement is not equaled by any other tissue. They grow rapidly, usually running their course in from six months to three years. The fourth group includes tumors of the renal pelvis and ureters. Tumors of the renal pelvis are of two types, the papillary and the squamous. The pathogenesis of these two types of tumors is fully described.

Every phase of the book is well prepared and interestingly presented. It should be recommended to genito-urinary surgeons, surgeons in general, and students of surgical pathology.

VIRGIL S. COUNSELLER, M.D.

ATLAS DE RADIOGRAPHIE OSSEUSE II—
PATHOLOGIE (SQUELETTE PATHOLOGIQUE)
1 Lésions traumatiques, by G. HARET, A. DARIAUX, Electro-radiologistes des Hôpitaux de Paris, and JEAN QUÉNU, Professeur agrégé à la Faculte de Médecine Chirurgien des Hôpitaux de Paris 2 Lésions non-traumatiques, by ETIENNE SORREL, Chirurgien de l'Hôpital Troussseau, Ancien Chirurgien en chef Hôp. Mme de Berck, and MME SORREL-DEJERINE, Ancien Interne des Hôpitaux de Paris Two volumes of 344 pages, 897 figures, of which 519 are radiographs and 378 drawings Published by Masson et Cie, Paris, 1931 Price, 310 francs for the two volumes

This atlas in two volumes presents a most interesting review of the subject. It will have a distinct value in a reference library. The one drawback, which applies to all similar attempts, is the necessary limitation of the number of illustrations, but the choice of these has been made wisely, resulting in a wide range of subject material presented clearly and comprehensively.

Diagrammatic sketches accompanying the majority of the illustrations elucidate the anatomico-pathologic changes from the normal and add considerably to the value of the books as reference volumes. This applies particularly to the first volume on fractures and dislocations, the accompanying sketches are very helpful in interpreting the roentgenographic reproductions of various types of fracture and the resultant deformities.

The limitations are more apparent in the second volume, but one is surprised by the number of subjects touched on and the excellence of the reproductions, allowing many subjects to be well presented by a single illustration. Tuberculosis of bone and joint, including the spine, is particularly well illustrated. Characteristic examples of syphilitic bone lesions are well chosen. Bone tumors are limited in number but the types have been particularly well chosen to show the pathognomonic characteristics of each. Various types of the arthropathies, the arthropathies associated with central nervous system syphilis and syringo-

myelia, osteitis deformans, von Recklinghausen's disease, multiple congenital exostoses, epiphysitis in the spine, rickets, achondroplasia, osteochondritis juvenilis and the coxa varas of adolescence are all well illustrated.

A most interesting group of congenital anomalies and congenital absence of bones is presented. Excellent illustrations of various

grades of osteomyelitis and melorheostosis, hydatid cyst of the ilium, osteochondritis dissecans and osteochondromatosis round out a volume which will be most useful in determining the nature of the rare lesions periodically met with in the routine of a roentgenologic practice.

C G SUTHERLAND, M D

ABSTRACTS OF CURRENT LITERATURE

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THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

J N Ane, M D
Henry Bayon, M D
Samuel Brown, M D
John R Carty, M D
B J DeLaureal, M D
M J Geyman, M D
N G Gonzalez, M D

John E Habbe, M D
H W Hefke, M D
Joseph Maldonado, M D
Ernst A May, M D
Ernst A Pohle, M D, Ph D
Charles G Sutherland, M D
W W Whitelock, Ph D

ABSCESS

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A study of subphrenic abscess is largely anatomic, since the pus is localized in well-defined areas. Barnard completely described the subphrenic spaces and divided the subdiaphragmatic area into five regions. The author discusses each of these in detail. Infection spreads along anatomic lines to well-mapped subphrenic areas. A knowledge of these areas is necessary for diagnosis and proper drainage.

The greatest help in diagnosis is roentgen examination. The diaphragm is elevated, fixed, and frequently deformed. If gas is present, it can be easily seen. Pneumoperitoneum may be of great value in determining the presence of adhesions between the diaphragm and the liver.

The only favorable outcome without operation is perforation into a bronchus, however, without operation, practically all patients die. With operation, the mortality is approximately 50 per cent. The transpleural operation, done in two stages, is advocated as the safest and most direct approach for abscess above the liver.

CHARLES G. SUTHERLAND, M.D.

BONE (THERAPY)

Fractures of the Calcaneus. The Subcutaneous Circular Metallic Suture in Those of Postero-superior Angle. Enrique Finocchietto and Marcelo Fitte La Prensa Med Argentum, Nov 30, 1931, XVIII, 831-835

Since fractures of the postero-superior angle of the greater tuberosity of the calcaneus, also known as Boer's or Destot's fracture, are so difficult to reduce and the results so unsatisfactory, the authors introduce a method which they consider excellent. They review the methods advocated and their pitfalls, and believe that the method described by them gives an assurance of reduction, there being no such long immobilization, besides

Their method is as follows. After due antisepsis of the ankle, a mark is made on its external surface which corresponds to the point where the superior border of the calcaneus ought to be after correction. Through this point, which is more or less half way between the posterior border of the malleolus and the posterior cutaneous surface of the Achilles tendon, a curved Doyen needle is introduced. It is first passed upward and then horizontally in a tangential line to the superior surface of the displaced calcaneous fragment, coming out on the anterior surface just opposite to the point of introduction. When the eye of the needle comes out, a wire is attached and the needle pulled out so that it will go through the same route as before. Then the needle is in-

troduced through the internal surface, following an imaginary line running tangentially to the posterior part of the internal surface of the calcaneus, coming out at the ankle. The needle is then carried upward, following close to the calcaneus and coming out where the wire was left before. The wire is then attached and the same course followed. A semi-circle has thus been followed. The next step is to carry the needle in a similar manner but through the external surface of the ankle. The wire is then pulled through the same tract and finally returned to the point at which the needle was originally introduced, thus forming a complete circle. The reduction is performed by twisting the ends of the wire, which is cut close to the skin, the incised point being covered with gauze. The foot is then immobilized for two weeks by means of plaster of Paris. The authors then present two cases with radiographs before and after reduction, which showed excellent results.

N G GONZALEZ, M.D.

BONE DISEASES (DIAGNOSIS)

Charcot's Disease of the Hip Joint, Report of a Case. Curtis A Hunsaker Med Bull Veterans' Administration, February, 1932, VIII, 155, 156

This is a case report of an ex-service man, 30 years of age, who complained of dizziness, blurring of vision, and occasional sharp pains in and about the right hip joint. He had contracted syphilis, in 1918, and had received antisyphilitic treatment for a period of ten months. At the time of admission, the physical condition of the patient was generally good, except for a speech defect and loss of reaction to light by the pupils. Spinal and blood Wassermann examinations were positive. Examination of the right hip joint revealed very little swelling and no evidence of inflammation.

The patient soon began to walk with a decided limp and, as the disease progressed, complained less of the sharp, stabbing pains. He also showed a definite change in his mental condition, having periods of depression and a general emotional let-down.

The destruction of the joint was slow and insidious but eventually amounted to an almost complete disintegration of the hip joint. The head of the femur was almost completely destroyed and the acetabular cavity was widened and showed much disintegration.

This case was believed to represent the osteosclerotic type of the disease, in which there is an increased hardening and density of the bone substance. The author emphasizes the value of the assistance of modern laboratories in distinguishing this case of Charcot's joint from some form of rheumatism or clinical arthritis.

J N AND M D

A Case of Necrosis of the Epiphysis after Healed Fracture of the Neck of the Femur Rolf Euren Acta Chirurgica Scandinavica, Dec 3, 1931, LXIX, 8-20

This is the report of a case of partial necrosis of the epiphysis in a boy, 13 years of age, following fracture of the neck of the femur, which had seemingly healed and was functioning well, as shown by clinical and roentgenologic examinations.

For more than eight months after the accident signs of consistent necrosis were visible in the upper lateral portion of the epiphysis, followed by resorption and softening in the part affected, together with fragmentation and bowing due to weight-bearing. Regenerative processes gradually led to healing, with a resultant *coxa plana* deformation of the head, on the other hand, the articular cartilage seems not at any time to have suffered noteworthy pathologic changes.

Analogous to the healing of medial fractures of the neck in persons of advanced age, the author believes that a more or less complete necrosis of the epiphysis started in the present case, as a direct result of the fracture. Insufficient nutrition, due to original vascular lesions in the capsule, in the course of the following restitution led to lasting pathologic changes, of which the location and aspect were affected by mechanical factors and by the distribution of the blood vessels in the bone.

In accordance with this view of the case, the author emphasizes the necessity for extending the period of treatment in cases of fracture of the neck of the femur in children.

W W WHITELock, PhD

Multiple Manifestations of Subchondral Necrosis (Osteochondropathia Juvenilis, Osteochondritis Epiphysitis) W C Martin and Hugo Röcsler Am Jour Roentgenol and Rad Ther, December, 1931, XXVI, 861-867

With two-year follow-up studies, the case of a girl, eleven years of age, is presented, who showed multiple areas of subchondral bone disease in the femoral heads (resembling bilateral Perthes-Calve-Legg's disease), the eleventh dorsal vertebra (Calvé's disease), the carpal scaphoid (Preisler's disease), the metacarpals and metatarsals (Köhler-Freiberg's disease) and also in the astragali and clavicles. Symptoms and physical findings were limited to the back and hips, and the only active therapy consisted in a spine fusion operation at the level of dorsal kyphosis. The disease is considered by the writers not to be one of endocrine disturbance or disturbance in calcium metabolism but rather a specific epiphyseal disease. Because of the tendency toward spontaneous healing palliative measures only are indicated until the disease becomes stationary.

J E. HABBE, MD

Slipping of the Upper Femoral Epiphysis A Study of Seventy Cases Albert B Ferguson and M Beckett Howorth Jour Am Med Assn, Dec 19, 1931, XCVII, 1867-1872

This is a study of seventy cases of a condition occurring between the ages of 8 and 17 years, described in the literature as epiphyseal fracture, separation or slipping, epiphyseal *coxa vara*, adolescent rickets, pathologic fracture, and femoral osteochondritis of adolescence. It is a disease characterized by weakening of the epiphyseal disc at the femoral head, permitting subsequent displacement of the head in the neck. It has been suggested that the disease is due to trauma, static forces, rickets, osteomalacia, infection, and endocrine imbalance. The pathologic features are sclerosis, thickening and avascularity of the soft tissues about the neck, with absence of any primary disease of the bone or cartilage. Four stages are described: Preslipping, slipping, quiescent and residual. Definite symptoms, physical signs, and roentgenographic evidence of the disease are always present in the preslipping stage. Early diagnosis is essential for the best results. Adequate rest for the hip is the most important factor.

CHARLES G SUTHERLAND, M D

CANCER (DIAGNOSIS)

The Present Status of Cancer Research M Borst. München med Wchnschr, Oct 9, 1931, LXXVIII, 1745-1750, also October 16, LXXVIII, 1785-1790

In a very precise manner this excellent German pathologist reviews the past and present of cancer research. It cannot be denied that cancer is on the increase, although very slowly. At present animal experimentation appears to prevail in the research of cancer. The theories of Cohnheim, Ribbert, and Virchow are considered from the standpoint of the modern clinician, who can add to them the theory of the pre-cancerous condition.

At the present the thought that cancer may be produced by parasites has been laid aside. To produce a cancer a certain disposition for it must exist in the patient. It must be admitted that, although a tremendous amount of scientific work has been done, it is not known yet how a cancer cell originates from a normal cell. It seems that internal secretion can take part in this. Cancer resistance, the opposite side to disposition, is the power which does not permit healthy tissue to accept a transplanted cancer to grow. It may be influenced by change in living conditions, by disturbing the inner secretory functions, or by extraordinary physiologic conditions, such as pregnancy. The growing of human cancer tissue has not been very successful.

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J N ANÉ, M.D.

CANCER (THERAPY)

The Degeneration of the Chemistry of the Cancer Cell S Edlbacher Strahlentherapie, Dec 12, 1931, XLII 929-938

Following a discussion of the recent advances in our knowledge of the chemical processes in the cancer cell, the author comes to the conclusion that the solution of the cancer problem may be found by further research in metabolism

ERNST A POHLE, M D, Ph D

The Organization of the Fight against Cancer Ferdinand Blumenthal Strahlentherapie, Dec. 12, 1931, XLII, 809-820

This article has been written as an introduction to the volume dedicated to the Samariterhaus (Heidelberg) on its twenty-fifth anniversary. In this institute R. Werner has carried out his well recognized work on cancer. The author outlines in detail all problems involved in the organization of the fight against cancer. He emphasizes the advantage resulting from the connection of tumor clinics with universities. No hard and fast rules can be given at the present time, only one fact stands out. Without the full co-operation of the profession at large the cancer problem cannot be solved.

ERNST A POHLE, M D, Ph D

Radiotherapy in Carcinoma of the Cervix Uteri Hermann Wintz München med Wchnschr, Nov 13, 1931, LXXVIII, 1935-1937

Radiotherapy has shown excellent results in the treatment of cancer of the portio. Even in cancer of the corpus the results of radiotherapy are equal to those of operation. However, the results in adenocarcinoma of the cervix are still poor. Unfortunately, there are no statistics about the results of surgery. While the anatomic arrangement of the lymphatics leading to the portio and corpus is such that the disease remains localized for a long time, cancer of the cervix almost always spreads early into the parametria. Döderlein and others have proven that the cancer has already infiltrated the parametria long before the infiltration can be palpated.

Between January, 1916, and July, 1926, 32 cases of true carcinoma of the cervix were treated by the author. Of these, 15, or 47 per cent, are cured. In 25 of the cases an additional intra-uterine application of radium was given, besides the typical roentgen treatment of Seitz and Wintz. As the adenocarcinoma of the cervix is from 20 to 25 per cent less radiosensitive than the basal-cell carcinoma of the portio, the total dose has to be increased to 125

per cent, or 1,000 r units. The entire dose must be applied within three days. This will be followed by a severe reaction, with tenesmus and bloody stools. The increase in dosage from 110 to 125 per cent has brought about results which are at least equal to those of surgery. Both types of carcinoma are equal as to their radiosensitivity. However, the early spreading of the cancer in cervix cases will lower the five-year results considerably.

In conclusion, radiotherapy is to be given preference in the treatment of adenocarcinoma of the cervix. Radiation will reach the distant metastases in the lower pelvis much better than the knife.

E A MAY, M D

The Importance of Surgical Treatment in the Fight against Cancer H v Haberer Strahlentherapie, Dec 12, 1931, XLII, 840-857

The well-known surgeon, who now holds the chair of Surgery at the University of Cologne, offers a very interesting account of his own impressions concerning the rôle of surgery in the treatment of malignant diseases. He emphasizes throughout the article the importance of early diagnosis. Among 10,035 major operations of his own, 1,277 were for malignant disease and less than 50 per cent of the latter could be operated on radically. All others could be treated only palliatively.

The author is rather skeptical about the value of pre- and post-operative irradiation in cancer of the breast. However, he admits the splendid results of irradiation in certain cases and stresses the importance of co-operation between surgeon and radiologist. In his opinion, the high mortality of major and difficult operations, as, for instance, in cancer of the sigmoid, is justified because without assuming this risk 100 per cent of the patients would die.

ERNST A POHLE, M D, Ph D

Methods and Results of the Fight against Cancer in Gynecology Robert Schröder Strahlentherapie, Dec 12, 1931, XLII, 858-869

This is a general discussion of the treatment of gynecologic cancer. In his own clinic the author observed, between the years 1923 and 1930, 585 patients with cancer of the cervix, 64 patients with cancer of the fundus, 62 with cancer of the ovaries, 30 with cancer of the vagina, and 97 with cancer of the vulva. About 68 per cent of carcinomas of the cervix occurred between the ages of 35 and 55 years. Definite relations between the histologic picture of the growth and prognosis could not be established in his cases.

Early diagnosis and treatment are of paramount importance. The mortality of Wertheim's operation

yet. The treatment of cancer is surgical and radiologic, serum treatment having failed

E. A. MAY, MD

Character and Cause of Cancer in the Light of Pathologic Anatomy and Experimental Pathology
A Dietrich Strahlentherapie, Dec 12, 1931, XLII, 913-928

This is a critical review of the outstanding accomplishments in the scientific search for the cause and nature of cancer. The recent work of Warburg dealing with the metabolism of the cancer cell is considered an important step in the right direction.

ERNST A. POHLE, MD, PhD

Metastases to the Bone from Cancer Editorial
Jour Am Med Assn, Oct 31, 1931, XCVII, 1304, 1305

With the introduction of the roentgen ray, greater accuracy in studying the incidence of bony metastases in the skeleton became possible. Copeland combined the roentgenographic and microscopic study in his series. The bones in which metastases most frequently were found in carcinomas of the breast were the spine, pelvis, femur, skull, ribs, and humerus. There were two types of metastatic lesions shown by the X-rays, a destructive lesion and a bone-forming process. Bloodgood has differentiated multiple myeloma by the punched-out areas of destruction. Bence-Jones bodies in the urine favor the diagnosis of multiple myeloma. A single focus occurred in only one-fourth of the cases and the majority of these were in the vertebrae or femur. Treated by the roentgen ray, patients may expect relief from pain and often a few months of comparatively comfortable living. In hypernephroma little attempt at the formation of new bone within the area of destruction was found. Irradiation alone offers as much for the prolongation of life as does surgical intervention alone or surgery combined with radiation. Osseous lesions in cancer of the prostate were most frequent in the pelvic bones, vertebrae, and femur. Roentgenograms showed the lesion to be of an osteoplastic nature with a marked increase in the formation of bone. Malignant disease of the testicle, carcinoma of the uterus, ovarian malignant disease, carcinoma of the stomach, carcinoma of the lung, and melanoma showing metastases to bone are analyzed. Copeland found evidence indicating that both an embolic and a lymphatic mode of involvement occurred.

CHARLES G. SUTHERLAND, MD

Schatzki Strahlentherapie, Dec 12, 1931, XLII, 821-839

This most interesting general review does not lend itself to abstracting since it covers such a wide subject. The ripe personal experience of the authors manifests itself throughout the article and many illustrative cases are quoted to support their standpoint. It is almost pathetic that they have to reach the conclusions "It is not the inadequacy of our diagnostic facilities that prevents us from improving our present results in the treatment of cancer but the sad fact that there are no marked early symptoms of cancer, except in very rare instances."

ERNST A. POHLE, MD, PhD

Sexual Physiologic Studies Hypophysis and Malignancy M. Borst, A. Döderlein, and D. Gostimirovic. München med Wochenschr, Dec 11, 1931, LXXVIII, 2108-2113

This article concerns the behavior and clinical value of the excretion of prolactin in women radiated for cancer of the genital organs. Prolactin is the sex hormone of the anterior lobe of the hypophyseal gland. In cancer cases, especially those of the female genital organs, the excretion of prolactin is increased, but the hormone is evidently produced in the anterior part of the hypophysis and not in the cancer tissue.

In cancer of the female genitalia, prolactin is found in the urine in 63 to 66 per cent. This figure increases after the first radiation and reaches 100 per cent after the second one. Even after an interval of six years, prolactin may be found in 50 per cent of the cured cases.

ERNST A. MAY, MD

A Clinical Study of Etiology of Gastric and Esophageal Carcinoma Lloyd F. Craver Am Jour Cancer, January, 1932, XVI, 68-102

The author investigates in detail histories personally obtained from 36 patients with cancer of the stomach and 18 patients showing cancer of the esophagus. There were no control cases, however.

He concludes that there is a definite difference between the predominant etiologic factors in carcinoma of the stomach and carcinoma of the esophagus. In the former, poor teeth, lack of teeth, gastro-intestinal diseases, heat of ingested food and drink, irregularity of meals, lack of water, seasoning, cathartic drugs, rapid eating, tobacco, and alcohol seem to have some importance in the order named.

In the case of cancer of the esophagus the following factors seem important in the order named: tobacco, alcohol, lack of water, poor teeth, lack of teeth, and cathartic drugs.

JOHN R. CARTI, MD

Early Symptoms of Cancer P. Morawitz and R.

afterward The treatment should cover the entire lower abdomen

The after-care of cancer cases consists of the restitution of the patients to health, so that they are able to work Every case must be followed up and examined at regular intervals Recurrent cases should receive only radiation Hopeless cases should receive relief from pain and suffering as much as is possible

E A MAY, MD

CHEST (DIAGNOSIS)

Case Reports of Congenital and Acquired Bronchiectases (Cystic Lungs) Thomas Canigiani Röntgenpraxis, Dec 15, 1931, III, 1116-1120

The pathologists have described cysts and cavities of the lungs rather frequently as congenital anomalies Clinical and roentgenologic observations have not been made very often during the life of the patient Three such cases are described in detail

Clinically, chronic tuberculosis is usually suspected Roentgenologically, it seems impossible to distinguish between congenital and acquired bronchiectases, the history in such cases being of great importance If there is no lung structure within the cyst, one may suspect a congenital anomaly The differential diagnosis from echinococcal cysts is not often required

H W HEPKE, MD

Latent and Transient Exudative Serosities as the Cause of Cryptotuberculous Fever Collatino Cantieri Riv di Patol e Clin della Tuberculosis, November, 1931, V, 990-992

The concept of exudative pleuritis or peritonitis is generally that of a disease with a long course, whether of more or less acute nature or of slow and disguised form

The author demonstrates the existence of certain exudative tuberculous serosities, as the anatomic basis of a febrile process, for a time cryptogenetic, which have as a characteristic a marked lack of physical and general signs and a particularly short course, hence a very rapid reabsorption of the exudation There is no pain, no subjective disturbance which might direct attention to the thorax or the abdomen, in both of which all signs of a strong effusion are lacking

These morbid manifestations, however, possess a great practical significance as indicative of tuberculous infection Study of the case calls for explorative puncture, but with an especially fine and delicate technic, since we are dealing with a liquid through which the point of the needle may easily pass unnoticed, unless the hand is highly skilled

Roentgenologic examination is unable to tell us anything in certain cases, a few days after an explorative puncture of the thorax, with positive findings and with a liquid directly inflammatory It re-

veals to us the pleura completely free, the diaphragm mobile, no trace remaining of the morbid process evolved in that region

W W WHITELOCK, PhD

Case Reports of Free Fibrin Balls (Blood Fibrin Balls) in the Pleural Cavity Georg Grundner Röntgenpraxis, Jan 1, 1932, IV, 36-40

The author has been able to find 19 cases of free fibrin bodies in the literature He reports two new cases The general opinion is that these balls originate from fibrin, which comes from the exudate or from blood, by the thoracic paracentesis It was possible in one of these cases to remove these bodies from the pleural cavity during a thoracotomy for an empyema The histologic examination in this case showed the presence of fibrin, which must have originated from blood Introduction of a needle in the thorax should, therefore, be done very carefully

H W HEPKE, MD

A Review of Pneumoconiosis Further Roentgenological and Pathological Studies Henry K. Pancoast and Eugene P Pendergrass Am Jour Roentgenol and Rad Ther, October, 1931, XXVI, 556-614

Pneumoconiosis must now be looked on as a more or less necessary risk in the progress of civilization Since the roentgenologic examination is the most accurate and satisfactory method of detecting it from the earliest to the most advanced stages, it is essential that roentgenologists be familiar with all phases of the disease

The continuance of the term "pneumoconiosis" is advocated, for while silica is usually the active fibrosing agent, other agents are capable of directly causing fibrosis Others, such as coal and clay dust, tend to retard the action of silica, while some alkalies may enhance its action Certain very unusual features in the fibrosis occurring in asbestos workers have caused the term "pulmonary asbestosis" to be widely used

It has not yet been established as to just how much silica dust is necessary in the lungs in order to produce actual silicosis, however, investigations by the U S Public Health Service have shown that 10,000,000 particles containing about 35 per cent free silica per cubic foot of air could be tolerated over a long period without great injury to the lungs

Concerning pathology, the consensus of opinion is still in favor of the "dust cells" being of endothelial origin and being derived from the walls of the capillaries and lymphatics, which are in intimate relationship with the alveolar epithelium From the alveoli these "dust cells" migrate to the lymphoid deposits, pass then to the larger lymphoid deposits, and then to the pulmonary lymph nodes, some being stopped at each of these way-stations along the

in his 176 cases amounted to 19 per cent, with a five-year cure of 40 per cent. Radium has become a strong competitor of surgery. From 60 to 100 mg of radium, heavily filtered, are placed near the tumor, and $3 \times 2,000$ mg-hr at 8-, 14-, and 21-day intervals are applied. The five-year cure reaches from 35 to 40 per cent, but one must not forget that about 10 per cent of the inoperable cases can also be saved. The value of radiation therapy is further clearly demonstrated in the treatment of recurrences following operation.

ERNST A. POHLE, M.D., Ph.D.

Cancer Therapy in Gynecology. F. von Mikulicz-Radecki. München med Wehnschr, Nov 20, 1931, LXXVIII, 1993-1999.

The modern fight against cancer consists of three stages. The early discovery and proper diagnosis of the case, the actual treatment, and the after-treatment and after-care of the patient. The results in cancer therapy depend at present mostly on the early diagnosis.

In Germany, several districts have already made remarkable progress in propaganda and instruction of the population, especially physicians, as to the early signs of cancer. Every woman suffering from hemorrhages must be examined by palpation and inspection. Every suspicious condition must be considered as being possibly carcinomatous. A section should not be made by the practitioner but by the specialist who is to treat the case afterward. Rational treatment should follow the section immediately. Absolutely condemned are any such incomplete measures as scraping out the crater of the portio, imputation of a cauliflower tumor, simple vaginal extirpation of the uterus in carcinoma of the cervix, electrocoagulation of a cervical carcinoma alone, or simple excision of a cancer of the vulva or urethra. All these measures are only palliative, not radical, and darken the outlook of further radical treatment and ultimate cure.

The problem is more serious than any statistics show, as a high percentage of the cases do not enter a hospital and are not reported. The author requests that cancer patients be referred to special institutions, which are fully equipped to take care of them. Since statistics have proven that radiotherapy in the treatment of female genital cancer is at least equal to operation, most of the cases receive radiotherapy, for the inoperable ones can also be treated with a chance of cure. However, there are those who advocate the combination therapy. The operable patients receive a pre-operative radium or roentgen treatment, which may reduce the size and extension of the growth. This is followed by radical operation. After the patient has sufficiently recovered, post-operative roentgen treatment is given.

Another method is the so-called selective therapy. Since only cases which are very good operative risks

undergo operation, every one with mild or severe complications from the heart, lungs, kidneys, thyroid, etc., is referred for radiation. This reduces the operative mortality and thus increases the relative number of cures. Cases which six weeks after radiation do not show a good improvement are also subjected to operation.

A further method is to select the cases from the histologic viewpoint, however, this is still very difficult. In cancer of the neck of the cervix the operative method shows an absolute cure of 19, or 1 per cent, and a relative cure of 35, or 6 per cent. The comparative results in radiotherapy are 17, or 4 per cent, and 42, or 7 per cent, in operative and borderline cases, and 11, or 1 per cent, in inoperable cases. The combination treatment at the Berlin clinic shows an absolute cure in 36 per cent and a relative cure of 49, or 2 per cent, in operable and 16 per cent in inoperable cases. All cases of Group 1 of Döderlein, also all early adenocarcinomas, are operated on, except those with even light contraindications. Also, all cases below 35 years of age are radiated. If six weeks after radiation these cases do not show marked improvement, an operation is indicated. The method of operation is the vaginal radical operation as developed by Stoeckel. Cases of Groups 2 and 3 receive first an intrauterine and intravaginal radium dose of from 2,500 to 3,000 milligram-hours. If after six weeks the cancer appears to be operable, operation is performed, if not, a second radium application plus a course of X-ray treatments are given with 100 per cent over the entire lower pelvis. All cases operated on receive prophylactic X-ray treatment.

Cauterization or electrocoagulation of a cancer of the cervix is to be avoided, as a beneficial action has never been seen and the cancer cells left behind seem to be more virulent than before.

In cancer of the corpus uteri, the results are better than in cancer of the cervix. Here the ratio of the collective statistics among the methods of operation, radiotherapy, and the combination of the two in absolute cures is, respectively, 42, or 8 per cent, 42, or 7 per cent (Wintz), and 48 or 1 per cent. This again shows the superiority of the combination method.

As in cancer of the vagina both methods give poor results, the author suggests surgery and post-operative treatments in operable cases. The same holds true in cancer of the vulva. In cancer of the urethra, radium is to be preferred to operation, perhaps combined with extirpation of the inguinal glands, radiation to follow. Cancer of the tubes is very rare and is diagnosed only at operation. The method of total extirpation and post-operative radiation is recommended. Most cases of cancer of the ovaries come under medical observation after having reached an inoperable condition. Still operable and borderline cases should be operated on and radiated.

bestos particles At any rate they are considered absolutely characteristic of pulmonary asbestosis

Röntgenographically, the findings, while rather unusual, cannot be considered characteristic. In several groups of cases studied the evidence of fibrosis was found first on the left side, although other workers have not confirmed this finding. Characteristically, the interstitial fibrosis seems predominant and often one is apt to underestimate the degree of disability unless careful roentgenoscopic observations are made which may demonstrate a surprising degree of restriction. Even in the later stages the interstitial fibrosis may predominate. Without adequate protection the prognosis is considered grave, although no definite tendency to susceptibility to tuberculosis in the presence of asbestosis has been yet established

J E HABBE, MD

Some Forms of Chronic Bronchitis Mariano R Castex La Prensa Med Argentina, Dec. 10, 1931, XVIII, 879-887

Though the knowledge on this subject is familiar to everyone, it is of great importance because of its common occurrence and also because of its complications, such as bronchiectasis, pulmonary emphysema, fibrosclerosis, adenocellulitis of the mediastinum, myocardial insufficiency, etc. The microbiologic study often reveals the causative bacteria, and thus the successful treatment is instituted. Some cases are due to amebiasis, and emetine promptly cures them. Others are due to infections of the tonsils and disappear after their removal. A third type of chronic bronchitis is due to infection of the maxillary sinuses.

The author presents four cases, together with their corresponding radiographs, which showed improvement following a maxillary sinus drainage. Other factors relating to the etiology are familial tendencies, the influence of certain diseases, such as syphilis, tuberculosis and gastro-intestinal disturbances, and the absence of Vitamin A in the diet.

N G GONZALEZ, MD

Bronchoscopy as an Aid in the Diagnosis of Obscure Pulmonary Disorders Edward A Looper Jour Am Med Assn, Oct 31, 1931, XCVII, 1287-1291

The present trend of the bronchoscopic art is to bring additional help to the internist in the investigation of the larynx, trachea, and bronchial tree. The surgeon can often obtain much helpful information from endoscopic examinations. In lung abscess co-operation between bronchoscopist and surgeon will insure the best results. In various parts of the country a great opportunity exists for bronchoscopic investigations in sanatoriums, special clinics are suggested to take advantage of this opportunity. In chronic cases the decision of some

unrecognized or complicating condition may rest largely on bronchoscopic examination

Bronchoscopic examination may reveal a local cause for repeated attacks of hemoptysis. Used with iodized oil injection or pneumography, it is also helpful in outlining lung abscesses, atelectasis, new-growths, and bronchial stenosis. A series of cases are reviewed to show the application of the above mentioned points

CHARLES G SUTHERLAND, MD

Advantages of Intubation Method of Introducing Iodized Oil for Bronchography in Children Samuel Iglauder Jour Am Med Assn, Nov 21, 1931, XCVII, 1517-1521

Bronchography should be employed more frequently in children, for many chronic pulmonary diseases, particularly bronchitis, pneumonitis, bronchiectasis, and lung abscess very often originate during the early years of life. It is contra-indicated in the presence of high fever, dyspnea, or recent hemoptysis, in cardiac decompensation, and in cachectic individuals.

In the intubation method a modified, all-metal O'Dwyer intubation tube is used. The modification consists in the addition of a second small bore tube soldered into a longitudinal groove in the posterior wall of the original intubation tube, thus creating a double-barreled tube, with one channel to provide for breathing and a second channel to convey the oil. The intubation tube is introduced by touch.

To obtund the cough reflex about 4 cc. of a procaine solution is slowly injected through the rubber tubing into the trachea and bronchi. With the patient in the upright position behind a fluoroscopic screen, iodized poppy-seed oil, 40 per cent (Iopiodol), is injected under fluoroscopic control. The injection of any alveoli should be avoided. From 10 to 20 cc. is usually sufficient. It is advisable not to remove the intubation tube before the roentgenograms are made, as the extraction of the tube excites a cough reflex which tends to scatter the oil within the lungs.

CHARLES G SUTHERLAND, MD

CHEST (GENERAL)

The Bronchial Bifurcation in Mitral Lesions C Donovan, A Battro, and Gazotti La Prensa Med Argentina, Dec 10, 1931, XVIII, 905-913

The authors begin their paper by giving the normal anatomy of the bronchi and emphasize the fact that the right bronchus runs vertically while the left one runs horizontally. Due to the relation of the left bronchus to the left auricle, anything affecting the size of the latter is going to affect the direction of the former. Mitral stenosis and mitral insufficiency provoke a dilatation of the left auricle. Several authors, such as Vaquez and Bordet, Steel,

route of pulmonary lymphatic drainage and producing lymphatic obstruction and subsequent fibrosis

More recent views on the termination of the dust cells are that at some point or another these cells die and liberate their silica particles, the liberated silica being the important factor in producing the end-result of fibrosis. At certain points along the lymphatic channels there may be sufficient clogging, so that some of the cells break through the walls of the blocked vessels and set up a fibrosis reaction in the interstitial lung tissues. With blockage of the hilum-ward lymph flow, a backflow toward the subpleural lymphatics takes place, resulting in peripheral nodulation and thickening of the pleura and adhesions. While, theoretically, removal of the dust hazards from an individual developing pneumoconiosis should be followed by a certain amount of clearing of the lung by elimination of some of the dust particles from the pulmonary lymphatics, the authors believe that once established silicosis is progressive, and any improvement following cessation of dusty work is apparent rather than real. All extensive studies of silicosis show that workers who develop the condition with any degree of rapidity are predisposed to respiratory infections, especially bronchitis, pneumonia, and tuberculosis. Tuberculosis affects particularly those in whom silicosis develops most rapidly, hence it can be controlled to a certain extent by measures directed against the rapid development of silicosis.

Spontaneous pneumothorax is a not infrequent accident in the course of the development of pneumoconiosis and is almost always in the upper lobe. Pleural effusion, as a direct complication in the course of pneumoconiosis, has never been encountered by these writers.

Roentgenologic studies to be complete must include both roentgenoscopy and stereoscopic roentgenography, the former procedure being especially important in determining respiratory capacity. The commonly used roentgenologic classification of involvement is first, second, and third stage. The first stage, which, in the belief of the writers, should have no definite medico-legal status for awarding compensation, shows a definite increase in the prominence and extent of the hilar shadows, increased prominence and thickening of the trunk shadows, and greater prominence of the linear markings of the peripheral zone. It is emphasized that this appearance is not characteristic of pneumoconiosis but may be simulated by passive congestion, acute or chronic respiratory infections, chronic, bronchial catarrh, and bronchiectasis.

The second stage, which is the most characteristic of the three, is indicated roentgenographically by the presence of small rounded densities, varying in size from a pin head to a pea, distributed throughout both lungs but most numerous about the lung roots and least frequent in the apical regions and

bases. Theoretically, these appearances should be superimposed upon the first stage appearances, but often the latter are absent, either being obscured by emphysema or being in some measure resolved, if peripheral lymph block occurred early.

The third stage of the disease shows a diffuse fibrosis predominating, which may be in the form of large coalescing nodules, more or less diffuse fibrosis, or massive fibrotic areas resembling extensive consolidations. Diaphragmatic excursions are usually greatly restricted or absent.

The writers believe that the time has come for the adoption of a more satisfactory classification of this disease process on a pathologic basis which will include the typical and the variants and be applicable to both clinical and roentgenologic studies for all industries and occupations. Their classification is in five groups as follows:

- (1) Peribronchial-perivasculary lymph node predominance
 - (a) rapid
 - (b) slow
- (2) Early interstitial predominance (interference with diaphragmatic movement)
 - (a) with nodular appearance
 - (b) without nodular appearance
 - (c) rapid or slow
- (3) Late or advanced interstitial predominance
- (4) Nodular predominance
 - (a) non-progressive
 - (b) progressive
- (5) Advanced diffuse or terminal fibrosis
 - (a) conglomerate nodular type
 - (b) interstitial type
 - (c) massive fibrosis type

In the latter part of the article certain dusty industries are considered individually, those included being coal mining, the asbestos industry, the abrasive industry, hard rock mining, the sandstone industry, the granite industry, the slate industry, iron mining, the cement industry, and vitreous enamel painting. Particular attention is given to the asbestos hazard and to the roentgenologic appearances of what has been termed "asbestosis".

The harmful products of the asbestos factories are almost entirely silicates, chiefly hydrate magnesium silicate. "Asbestos bodies" occurring in a number of different forms and found on necropsy examination in the lungs of patients dying of asbestosis, are one of the most remarkable features of this form of pneumoconiosis. The most characteristic form is found in the alveoli and bronchioles and in fibrous and necrotic areas. They are from 20 to 100 microns in length and are often dumb-bell shaped. They are golden yellow or brownish in color. Theories as to the nature of these bodies are that they are osmotic silica infarcts, particles of ferruginous quartz, or some colloidal product of the original as-

of dust containing iron particles even in great quantities does not apparently lead to any pathologic changes in the lung tissue, except to cause a pigmentation. It is the presence of the silica in the dust which produces fibrosis. The *modus* of invasion and the pathologic sequences produced by the entrance of silica-dust into the lungs are described. The anatomic and clinical pictures and roentgenograms were thoroughly investigated.

The author examined roentgenologically 140 men who were employed as workers in iron mines in the Ukraine. They were all drillers, and the dust content of the air was high (from 12,000 to 13,000 dust particles per cubic centimeter). Eighty-two of the 140 men were found to have a fibrosis in the first stage (their average working time had been 151 years), 40 were found to have a fibrosis of the second stage (their average working time was 182 years). A third-stage fibrosis could be found only among some who had been invalids and were no longer employed. Four such men had worked for an average of 357 years.

The roentgenologic appearance of the silicosiderosis cannot be differentiated from the pure silicosis. The fibrosis must be explained by the action of silica, the iron might even give a certain amount of protection. Three types of lung siderosis must be distinguished: (1) Siderosis of metal grinders (silico-siderosis gravis), (2) siderosis of workers in iron mines (silico-siderosis leesus), (3) siderosis of glass polishers (siderosis pura or chromatica).

H W HEFKE, M D

Yeast Infection of the Lungs T R. Healy and L. B. Morrison Am Jour Roentgenol and Rad Ther, September, 1931, XXVI, 408-413

Fungi may attack any organ or system of the body and are most common in the integumentary system, while the nervous system is least frequently involved. The exact mode of development of the infection in the human being is not certain, although, undoubtedly, breaks in the skin favor entry. In other cases, inhalation of dust containing the mold may be the portal of entry. Since the geographic distribution of these fungi is wide, yet the frequency of the disease is not great, it is reasonable to assume that man possesses a considerable degree of natural immunity.

Symptoms of fungus infection in the lungs may vary from that of mild bronchitis to that of advanced phthisis. Cases may go on to spontaneous cure or terminate fatally. The diagnostic triad of absence of tubercle bacilli in the sputum, apparent discrepancy between the roentgen evidence of extensive disease and the clinical appearance of fair health, and of the presence of yeast cells in the sputum is stressed by the writers. Five cases are reported, all showing *Blastomycetes imperfecti* in the

sputum, and are illustrated with the chest roentgenogram of each.

J E HABBE, M D

CHEST (THERAPY)

Treatment of Cavities in the Vertex of the Lung by Apicolysis and Packing Alejandro J Pavlovsky and Antonio A Cetrangolo La Prensa Med Argentina, Jan 10, 1932, XVIII, 1049-1068.

Recently in Central Europe there have been many articles on this subject. The authors state that since about 5 per cent of pulmonary tuberculosis cases are surgical, this treatment ought to be applied to a selected number of those cases. They review the literature and state that the poor results obtained with this method were finally overcome by the use of a special mixture of paraffin first introduced by Baer, in 1913. The authors believe that the ideal indication for such a procedure is a cavity process of long standing, well limited, the rest of the lung being normal, and the other lung uninvolved.

All the cases on which the authors have practised this treatment have had the following: (1) General dietetic, hygienic, and climatic therapy, (2) sanocrysin, (3) unsuccessful attempts at pneumothorax, and (4) phrenicectomy. The authors explain why this treatment is more agreeable and more successful than thoracoplasty. Their method consists of a posterior incision, resection of 3 cm of the third rib, freeing of the parietal pleura, breaking all the adhesions, and packing with Baer's paraffin mixture, following which the wound is closed.

They conclude their article by presenting eight cases with complete radiographs before and after operation. Judging by the histories of those eight cases, their main difficulty is in introducing enough Baer's paraffin mixture.

N G GONZALEZ, M D

CIRCULATORY DISTURBANCES

Bleeding of Benign Origin Leo Kessel Jour Am Med Assn, Oct 10, 1931, XCVII, 1058-1060

Acute bleeding arouses at least three grave suspicions: a blood dyscrasia, the ulceration of a malignant neoplasm, or a chronic inflammatory process, particularly tuberculosis.

This report of a series of interesting cases deals with a group of patients in whom serious organic disease was excluded, yet presenting a history of hemorrhage. Bronchoscopy revealed in one a plexus of dilated veins at the base of the tongue, in another a broncholith, with a piece of nut shell as a kernel, filled the right lower bronchus with a mass of granulation tissue which bled easily. Lupus of the trachea was the cause of another hemoptysis of three years' duration. Benign tumors of the bronchus accounted for two, and multiple telangiectasis

Peterson, Gäbert, and others have studied the radiologic changes of mitral stenosis

The authors go into detail in regard to the changes in mitral stenosis, particularly in reference to the exaggerated aperture of the bronchial bifurcation. They conclude their paper by presenting a chart of fourteen cases, with the diagnoses, angle of bronchial divergence, and deformity of esophagus

N G GONZALEZ, M D

Pulmonary Conditions under Strain (Certain Radiologic Modifications in the Lungs of Athletes in Breathing Pauses before, during, and after the Strain) Gioacchino Arnone Riv di Patol e Clin della Tubercolosi, Jan 31, 1932, VI, 57, 58

This report is in response to a resolution of the Italian Fascist Society for Scientific Study of Tuberculosis drawn up at its session of May 29, 1931, calling for extension of the system of individual charts of the respiratory system, not alone to schoolchildren and workmen, but also to those engaged in sports, for prophylactic, eugenic, and medico-legal purposes. The report was made at the session of the Society at Palermo, on July 10, 1931.

On the basis of radiograms made in breathing pauses in the case of individuals engaged in various sports, and studied in conjunction with the cardiac tonus before, during, and after the strain, the following conclusions were reached:

Shadow of the Hilus—This is seen to be fuller and more extended than normal in repose. During the strain it is more ample, and its tissue stands out more clearly, owing to the greater transparency of the lung. After the strain, the return to normal occurs within from 7 to 40 minutes, according to the degree of relaxation and to heart conditions.

Pulmonary Trauma—During repose it is clearly evident in the median zone, becoming more so during the strain, owing to the clearing up of the pulmonary field. The tuberculae are more distinctly visible being more separated, owing to greater aeration of the lungs. After the strain the trauma is compact, as in repose.

Nodular Shadows—In repose, these are very numerous, both on the right and left, in the lung as well as in the hilus, so as to simulate a lymphatic tuberculosis with numerous nodules of infiltration of the median pulmonary regions. During the strain some of the nodules are less evident or even imperceptible, others are more evident, either because enlarged and denser, or owing to the greater aeration of the lung. After the strain the shadows become as during repose.

The nodular shadows are of two kinds (1) Nodular shadows of irregular outline scattered in the pulmonary field and in proximity to the hilus, which disappear or become modified during the strain, (2) nodular shadows of regular outline, in-

tensely opaque, often accompanied by ring-shaped shadows of approximately the same caliber, which increase in volume during the strain. The former are due to circumscribed vascular ectasia, or to crossing of vessels, the latter are due to infiltrated vessels.

One of the nodular shadows, accompanied by the shadow of the bronchus, on being examined and measured, was seen to increase during the strain by 1.5 mm. in vascular caliber and by 2 mm. in bronchial caliber.

Explanation of the data placed in evidence is closely connected with study of the heart and vessels, of their tonus and normal function during the strain.

Limiting ourselves for the moment to the radiologic observation of respiration of the lung, it may be stated that in the lung of the athlete during a pause in the period of strain there appear shadows of the hilus and lung, due to a vascular network more vigorous than under normal conditions, in a state of functional equilibrium.

W W WHITELOCK, Ph D

The Postpneumonic Lung A Critical Review
Alan L Hart Am Jour Roentgenol and Rad Ther, September, 1931, XXVI, 371-396

Following an acute pneumonic process, any one of three conditions may occur: Absorption of exudate, with return to normal of lung tissue, organization of exudate, with fibrosis and development of non-tuberculous infections, suppuration, with possible abscess formation or other sequelæ. Such pneumonias as the influenzal, with or without streptococcal invasion (Friedländer's), and the bronchopneumonias following measles and pertussis, in which the connective tissue framework of the lung, the walls of the bronchial tree, and blood and lymph vessels are most seriously damaged, are most prone to chronic lung changes. The resulting fibrosis, if diffuse, may cause considerable impairment of function. Serial roentgenologic studies afford the best means of following the course of these chronic lung changes when resolution does not take place promptly.

An excellent chart, giving briefly the gross and microscopic pathology in the various component parts of the lung, with frequency of development of suppuration in the lobar and several types of bronchopneumonias, is a valuable aid to roentgenologists. It enables them to interpret the roentgen changes in terms of pathology in those cases in which prompt and complete resolution fails to occur.

J E HABBE, M D

Siderosis of the Lungs N A Podkaminsky Röntgenpraxis, Dec 1, 1931, III, 1071-1084

The dust from iron contains mainly either iron or silica in different combinations. The inhalation

of dust containing iron particles even in great quantities does not apparently lead to any pathologic changes in the lung tissue, except to cause a pigmentation. It is the presence of the silica in the dust which produces fibrosis. The *modus* of invasion and the pathologic sequences produced by the entrance of silica-dust into the lungs are described. The anatomic and clinical pictures and roentgenograms were thoroughly investigated.

The author examined roentgenologically 140 men who were employed as workers in iron mines in the Ukraine. They were all drillers, and the dust content of the air was high (from 12,000 to 13,000 dust particles per cubic centimeter). Eighty-two of the 140 men were found to have a fibrosis in the first stage (their average working time had been 15.1 years), 40 were found to have a fibrosis of the second stage (their average working time was 18.2 years). A third-stage fibrosis could be found only among some who had been invalids and were no longer employed. Four such men had worked for an average of 35.7 years.

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H W HEFKE, M D

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J E HABBE, MD

CHEST (THERAPY)

Treatment of Cavities in the Vertex of the Lung by Apicotomy and Packing Alejandro J Pavlovsky and Antonio A Cetrangolo La Prensa Med Argentina, Jan 10, 1932, XVIII, 1049-1068

Recently in Central Europe there have been many articles on this subject. The authors state that since about 5 per cent of pulmonary tuberculosis cases are surgical, this treatment ought to be applied to a selected number of those cases. They review the literature and state that the poor results obtained with this method were finally overcome by the use of a special mixture of paraffin first introduced by Baer, in 1913. The authors believe that the ideal indication for such a procedure is a cavity process of long standing, well limited, the rest of the lung being normal, and the other lung uninvolved.

All the cases on which the authors have practised this treatment have had the following: (1) General dietetic, hygienic, and climatic therapy, (2) sanocrysins, (3) unsuccessful attempts at pneumothorax, and (4) phrenicectomy. The authors explain why this treatment is more agreeable and more successful than thoracoplasty. Their method consists of a posterior incision, resection of 3 cm of the third rib, freeing of the parietal pleura, breaking all the adhesions, and packing with Baer's paraffin mixture, following which the wound is closed.

They conclude their article by presenting eight cases with complete radiographs before and after operation. Judging by the histories of those eight cases, their main difficulty is in introducing enough Baer's paraffin mixture.

N G GONZALEZ, M D

CIRCULATORY DISTURBANCES

Bleeding of Benign Origin Leo Kessel Jour Am Med Assn, Oct. 10, 1931, XCIVII, 1058-1060

Acute bleeding arouses at least three grave suspicions: a blood dyscrasia, the ulceration of a malignant neoplasm, or a chronic inflammatory process, particularly tuberculosis.

This report of a series of interesting cases deals with a group of patients in whom serious organic disease was excluded, yet presenting a history of hemorrhage. Bronchoscopy revealed in one a plexus of dilated veins at the base of the tongue, in another a broncholith, with a piece of nut shell as a kernel, filled the right lower bronchus with a mass of granulation tissue which bled easily. Lupus of the trachea was the cause of another hemoptysis of three years' duration. Benign tumors of the bronchus accounted for two, and multiple telangiectasias

involving the nose, tongue, and lips accounted for another. In one case laryngoscopy revealed a cavernous angioma in the left vocal cord, while in another melena resulted from a small nevus in the anal ring, again, it was associated with a rash over the hands and back, typical of erythema nodosum.

In discussing this paper, Smithies stressed bleeding related to the menstrual cycle or menopause. He mentioned occupations in close relationship with some of the volatile hydrocarbons, leading to saturation of the blood to a degree adequate to produce leaking in the vessels followed by seepage from the capillary bed.

CHARLES G. SUTHERLAND, M.D.

CONTRAST MEDIA

Hepatosplenography Hans L. Popper and Erwin Klein. *Münchener med. Wochenschr.*, Oct. 23, 1931, LXXVIII, 1829, 1830.

The visualization of liver and spleen by the X-ray is of great aid to the clinician. Radt and Oka have accomplished this by intravenous injection of a colloidal thorium preparation. The authors have tried thorium dioxide on fourteen cases with good results. One of them was a large tumor of the liver, which could be seen on the film as a large defect. The preparation, which is called thorotrust, has no direct ill effects, even in large doses. It is very slightly radio-active. From 60 to 90 c.c. are injected. The best concentration in liver and spleen can be seen after from three to five days. However, in some of the cases, as well as in animal experiments, the dye could be found after seven months deposited in the spleen and liver at the same concentration. It is, therefore, to be used with the greatest precaution until further research proves the method to be harmless.

E. A. MAY, M.D.

Intratracheal Injection of Lipiodol Raúl F. Vacarezza. *La Prensa Med. Argentina*, Nov. 20, 1931, XVIII, 798-802.

The author gives a short outline of the methods used for visualization of the bronchial tubes with lipiodol, and his objections to those methods. He then introduces his method, which consists of the suppression of the swallowing reflex by means of anesthesia of the pharynx with 5 per cent cocaine chlorhydrate by spray. The patient is placed in abdominal decubitus and the lipiodol is placed at the base of the tongue. The amount of lipiodol used is usually 20 cubic centimeters. The results obtained have been excellent. Several radiographs are presented.

N. G. GONZALEZ, M.D.

Some Experiments in Rectal Pyelography Knut Wolke. *Acta Radiologica*, 1931, XII, No. 69, 49, 515.

The author compares the absorption efficiency of uroselectan and abrodil (skiodan), the latter being preferred and used in a group of 37 cases. Preparation of the patient and administration of the dye were done in the following manner:

Fluids were withheld for the twelve hours preceding the examination. Two hours after the patient had received an ordinary enema, roentgenograms were made of the urinary tract, after which four suppositories, each containing five grams of skiodan, were inserted into the rectum. The patient was then kept in a sitting position (to prevent ascent of the dye into the upper colon) for forty-five minutes. A roentgenogram of the urinary tract was then made. If there was evidence of dye in the kidney or ureters, compression was applied at the level of the sacroiliacs. The author repeatedly emphasizes the value of compression in all but retrograde pyelographic studies. A film was made about twenty-five minutes later and repeated every fifteen or thirty minutes, until results were satisfactory, or if no dye was noted two and one-half hours after administration, the procedure was stopped and a cleansing enema administered. Of 30 cases receiving 20 grams of skiodan, 18 showed good filling of one or both renal pelvis. The formula of the suppository used by the author was as follows:

| | | |
|----------------|-------|-------|
| Skiodan | 5 | grams |
| Ext belladonna | 0.007 | gram |
| Gelatini pulv | 2 | grams |
| Aq dest. | 1 | gram |
| Glycerini | 0.40 | gram |

M. J. GEYMAN, M.D.

DIAPHRAGMATIC HERNIA

Absence of Half of the Diaphragm (Thoracic Stomach, Diaphragmatic Hernia) Edward L. Jenkinson. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1931, XXVI, 899-903.

A case of thoracic stomach is reported, the diagnosis being first established roentgenoscopically when the patient was 68 years old. He had had more or less gastric complaint in the nature of spitting up of food and difficulty in swallowing since the age of 32. Roentgenoscopically the esophagus was found to be only about three inches long and to enter the stomach at the level of the sternoclavicular articulation. The greater curvature of the stomach was to the right, the pylorus to the left, pointing downward. The duodenal bulb was just about at the level of the normal esophageal opening in the diaphragm, intact on both sides, and the stomach empty at five hours.

Three cases of congenital absence of half of the diaphragm are also reported. Two were seen in the

new-born, one being left-sided absence, with the left chest containing small bowel and a portion of the large intestine, and the other right-sided absence, also containing parts of the large and small intestines. Both cases died a few days after delivery and each showed postmortem findings confirming the roentgenologic diagnosis. The third case occurred in a child, six years of age, who showed absence of the left half of the diaphragm, the stomach and splenic flexure being located in the left chest. This patient was submitted to operation but died. All three cases complained or showed signs of respiratory embarrassment.

J E HABBE, M D

EXPERIMENTAL STUDIES

The Significance of Unspecific Immunity in Cancer Therapy W Caspari Strahlentherapie, Dec 12, 1931, XLII, 899-912

The author gives in this paper a summary of his work published in a series of articles during the past 15 years and dealing chiefly with transplantation of tumors in mice and rats. He feels that the so called specific immunity plays an important role in the treatment of carcinoma.

ERNST A POHLE, M D, Ph D

Attempts to Record Alpha-ray Spectra of Very Low Intensity Georg Stetter and Roman Premm. Sitzb Akad Wiss Wien, Math-naturw Klasse, Abt IIa, 1931, CXL, 579-584

The purpose of the experiments was to overcome the difficulties of getting α -ray and H -ray pictures on photographic plates, these difficulties being due to the extreme sensitiveness of the photographic plate to many other influences. First, a suitable chemical process was sought, but nothing was found which would record a single α -particle. Next, a biologic method was tried. Fungus spores were embedded in gelatin on a plate and exposed to α -rays. The germination of the spores was reduced by the rays, but the plates could be used for qualitative observations only, since the proportion of naturally sterile spores varied greatly from plate to plate, and also the time required for germination was very variable. Last, a method was developed with a photographic plate, whereby if the α -rays impinged at nearly grazing incidence, the straight blackened track made by a single α -particle in the film could be observed microscopically and distinguished from blackening due to other causes.

CHEMICAL ABSTRACTS

Effects of Ultra-violet Rays, Radium, and X-rays on Proteins M Spiegel-Adolf Arch Path, 1931, XII, 533-542

Rays of short wave length produce effects on proteins that differ from the effects produced when

the protein solutions are heated to 100°. The reaction due to irradiation is irreversible. This criterion for differentiating between the two types of denaturation cannot be applied to proteins denatured in the presence of alkali, because, under these conditions, the heated protein also undergoes an irreversible change. Differences between alkaline solutions denatured by heat and those denatured by irradiation can, however, be detected easily with the aid of the quartz spectrograph or by determination of the dispersion quotients. Various types of rays, such as ultra-violet rays, X-rays, and Ra, produce effects on proteins that are qualitatively, though not quantitatively, similar. Coagulation of protein results from a few minutes of irradiation with the Hg arc, 3 hours' exposure to X-rays, and 9 hours' exposure to 80 mg of Ra.

The principal absorption bands of the solutions of proteins lie in the ultra-violet region of the spectrum. A conversion of part of the energy of Ra and X-ray radiations into ultra-violet rays should intensify the effect of these radiations on protein. Certain crystals that fluoresce in the ultra-violet region when irradiated by Ra or X-rays were enclosed in quartz tubes and immersed in the protein solution. Whereas proteins irradiated by X-rays and Ra without ultra-violet fluorescence exhibit no changes, the same proteins similarly treated in the presence of the fluorescent material are coagulated. Similar results were obtained with red blood cells and paramecia, and experiments are being carried on with tumor tissue of mice.

CHEMICAL ABSTRACTS

Transmission from Animal to Animal of the Fatal Toxic Disease Caused by the Filtrable Tuberculous Virus in the Guinea Pig Exposed to X-rays M Nasta, I Jovin, and M Blechmann Compt rend Soc de biol, June 30, 1931, CVII, 849-851

The authors were interested in determining whether the fatal toxemia resulting from inoculation of the filtrable tuberculous virus in the guinea pig exposed to X-rays could be transmitted. In order to prove that the transmitted disease was due to the tuberculous virus and not to a toxic property of the filtered products (urine, sputum, etc.), a series of guinea pigs were inoculated with a filtered tuberculous urine. Half the animals were submitted to X-rays. After each irradiation two irradiated animals and two non-irradiated, but all inoculated at the same time, were killed. The liver, spleen, kidneys, and lymph nodes of one of the animals were employed for inoculation to other guinea pigs, whereas the other served for microscopic examinations for tubercle bacilli and histologic survey of the organs.

The result of these experiments was that when transmissions were made with organs of animals inoculated with filtered

mals to which these transmissions were made (afterwards exposed to X-rays), developed fatal toxic accidents, whether or not the animals from which the organs were obtained had been exposed to irradiation. This proves that the toxicity of the filtrated products was due to the presence of a virus and not to toxic properties of the pathologic products (urine, sputum) of the organs injected. In addition, the presence of tubercle bacilli in the inoculated animals was demonstrated.

HENRY BAYON, M.D.

Effects of Cod-liver Oil and Ultra-violet Irradiation, as Influenced by Oyster Shell, in the Diet of Confined Laying Hens Walter A. Hendricks, Alfred R. Lee, and Albert B. Godfrey Jour Agric Research, 1931, XLIII, 517-535

Feeding cod-liver oil or administering ultra-violet irradiation to living hens confined without access to direct sunlight or green feed increased egg production and the thickness of the egg shells and improved the general condition of the birds. Both of these vitamin supplements also indicated a tendency to increase egg weight and improve the hatchability of the eggs. Cod-liver oil was superior to 15 minutes daily administration of the type of ultra-violet irradiation used as a supplement to the basal diet. When no cod-liver oil was included in the diet the addition of oyster shell increased egg production and thickness of egg shell even though mineral supplement was present in the basal diet. Oyster shell thus appears to be a source of easily available mineral or to contain a small amount of some factor which is present in cod-liver oil.

CHEMICAL ABSTRACTS

Microscopic Changes in the Internal Organs of Dogs after the Intravenous Injection of Tetraiodophenolphthalein Vsev Korkhoff and M. Okhowskaya Vestn Rentgenolog i Radiologii, 1931, IX, 105

Having observed that the intravenous injection of tetraiodophenolphthalein for gall-bladder examinations is often followed by various complications, the authors undertook a series of experimental investigations upon dogs. The experiments consisted in the intravenous injection of the dye in dogs and the microscopic examination of the tissues removed from the internal organs at various intervals after the dye injection. It was found that the sections of tissues removed from the animals a day after the injection showed definite abnormal changes, these changes being greater in the liver cells and bile ducts than in any of the other organs examined. Sections of tissues removed at later dates after the injection failed to show any abnormal changes.

The authors are of the opinion that some of the clinical reactions observed in human beings after the intravenous injection of the dye are due to the

abnormal changes which have taken place in the liver. They also believe that the more serious disturbances after the injection of the dye may be due also to impaired tissues in the liver as a result of some previous disease of the liver.

SAMUEL BROWN, M.D.

The Prevention of Experimental Duodenal Ulcer by Feeding Neutral Gastric Mucin M. S. Kim and A. C. Ivey Jour Am Med Assn, Nov 21, 1931, XCVII, 1511-1513

Fogelson found that from the gastric mucosa he could prepare a neutral mucin which had a high combining power for free acid. An ideal antacid, this does not markedly excite gastric secretion, is soothing or protective, and does not alter the body chemistry or disturb the gastro-intestinal tract. Under aseptic procedure a permanent biliary fistula was produced in twenty-seven days. A cholecystectomy was performed in all. The direct etiology of the ulcers following biliary fistula in dogs is unknown, the method having been used because of its simplicity.

Among the ten control dogs which received no mucin, ulcer of the duodenum developed in six, and three of the six had two ulcers. No ulcers developed in the seventeen dogs who received mucin with their food. On mucin, dogs with biliary fistula eat well and maintain their weight, which is not the general rule otherwise. On the basis of these observations, it is concluded that the administration of the mucin prevents ulcer formation in dogs with biliary fistula.

CHARLES G. SUTHERLAND, M.D.

Importance of Duration of Irradiations and Dose of Inoculated Virus for the Production of the Toxic Disease Caused by the Filtrable Tuberculous Virus in the Guinea Pig Irradiated with X-rays M. Nasta, I. Jovin, and M. Blechmann Compt rend Soc. de Biol., June 30, 1931, CVII, 847, 848

Following a previous investigation on the fatal toxic disease caused by the filtrable tuberculous virus in guinea pigs exposed to X-rays, the authors have endeavored to determine the number and minimal duration of the irradiations required to cause toxic phenomena in the experimental animals.

Six guinea pigs inoculated with 5 c.c. of filtered tuberculous urine were given a variable number (3, 2, 1) of exposures, lasting from 8 to 10 minutes each, two other animals were given only one exposure, lasting from 4 to 5 minutes. The interval between exposures was in general 5 days. The conditions of irradiation were identical in all the animals.

Of the two animals receiving 3 irradiations one died after the second irradiation 8 days after inoculation, with a loss in weight of 70 grams, the other died after the third irradiation 12 days after inoculation, with a loss in weight of 120 grams. Of the two receiving two irradiations one died in a

month, losing 120 grams, the other surviving. Of the two receiving only one irradiation, one died in 5 days, 7 days after inoculation, losing 90 grams, the other died more than a month after inoculation, losing 230 grams. Lastly, the two guinea pigs receiving only one irradiation with an exposure of only half the duration survived with a temporary loss of weight.

As demonstrated by these experiments, three exposures of the same intensity and duration were needed to produce fatal toxic results. It is true, however, that often the same results were obtained after one or two irradiations, these results depending evidently on individual differences in the animals (perhaps also on differences in toxicity of the virus employed), but these results are unusual, whereas after three irradiations death has been the uniform outcome.

In these animals, as in a number of others employed in previous experiments, the leukopenia occurring during the height of the toxemia reaches a level of from 5,000 to 6,000 leukocytes per cubic millimeter.

Regarding the importance of the dose of the inoculated virus, the authors have injected three groups of two guinea pigs each with 3, 2, and 1 c.c. of filtered tuberculous urine. The two animals inoculated with 3 c.c. and exposed to three irradiations both died one day after the last irradiation and 13 days after inoculation. The two animals inoculated with 2 and 1 c.c. have both survived after temporary loss of weight.

It follows from these experiments that the quantity of filtrable virus inoculated must not sink below a certain level in order to determine fatal toxemia.

HENRY BAYON, M.D.

Influence of Roentgen Rays on the Power of Fermentation of *Saccharomyces Cerevisiae*. Experimental Contribution to the Biologic Action of Roentgen Rays. Virgilio Gronchi. Bollettino dell'Istituto Sieroterapico Milanese, December, 1931, pp. 759-775.

From the results of numerous tests regarding the effect of roentgen rays on the power of fermentation of *Saccharomyces cerevisiae* in the presence of glucose, the author reached the following conclusions:

(1) Roentgen rays of 0.37 Å and from 0.16 Å, in dosages of approximately 600 to 1,800 r., exert on the *saccharomyces* a functional stimulus, as shown by increased speed in the production of CO₂.

(2) This stimulus of excitation, other conditions being the same, is proportional to the radiant energy involved.

(3) With equality of dosage and under like conditions the stimulative action is greater with hard rays than with soft rays.

W. W. WHITELOCK, Ph.D.

GALL BLADDER (NORMAL AND PATHOLOGIC)

An Effective Gall-bladder Stimulant to Supplant the Fat Meal. Lester Levyn. Am. Jour. Roentgenol and Rad. Ther., December, 1931, XXVI, 904.

Experiments were conducted to determine the effects of the various ingredients of egg-yolk in an effort to find an effective gall-bladder stimulant which would leave the stomach rapidly, thereby allowing the prompt beginning of a gastro-intestinal opaque meal examination. Lecithin was shown to be the most active stimulant to gall-bladder contractions, and it was found that by mixing fresh egg-yolk (45 gm.) with glycerin (55 gm.) and then adding 25 gm. of lecithin dissolved in 3 c.c. absolute alcohol, a mixture is obtained which is not unpleasant to take. In the standard dose of 10 c.c. it serves as an effective gall-bladder stimulant, yet passes rapidly out of the stomach and does not retard gastric peristalsis if a barium meal is given immediately upon completion of the cholecystographic study.

J. E. HABBE, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Gastroscopic Control of the Roentgen Findings in the Contour of the Gastric Mucosa. R. Schindler and H. Sielmann. München med. Wochenschr., Nov. 20, 1931, LXXVIII, 1989-1991.

The articles of Berg, Chaoul, Forssell, and others on the roentgen visualization of the gastric mucosa are of great importance. Small carcinomas and superficial ulcers can be well outlined, but to obtain information on minute details, gastroscopy is far superior.

In three cases the contour of the mucosa was such that a carcinoma of the greater curvature near the cardia was diagnosed by means of the X-ray. Gastroscopy revealed only normal mucosa. The patients are well to-day.

A diagnosis of gastritis is often made by X-ray examination, but cannot be sustained by gastroscopy. Inasmuch as a carcinoma of the other parts of the stomach can be easily demonstrated by the relief method of Berg, the gastroscopic method has differed in only one out of seven cases. The roentgen findings were negative, but the gastroscope detected a secondary carcinoma near the cardia. In ulcer both methods have equal results. However, the authors are convinced that in gastritis the gastroscopic method gives more exact results than the roentgen method.

ERNST A. MAY, M.D.

Thoracic Stomach A Beutel Röntgenpraxis, Jan 1, 1932, IV, 40-46

The author intends to classify the roentgenologic symptomatology of the "thoracic stomach" on the basis of cases reported in the literature and one case of his own. In this case two-thirds of the stomach was in the right chest, and the esophagus was very short. Symptoms which had been present since childhood suggested a congenital anomaly. An ulcer niche complicated the picture. A pneumoperitoneum might, in selected cases, be useful for the differentiation of the hernia contents and the demonstration of empty portions of the hernial sac.

H W HEFKE, M D

A Case of Pancreatic Stones Diagnosed during Life Wilhelm Schöndube Röntgenpraxis, Dec 1, 1931, III, 1095-1099

Only a very few cases of pancreatic stones have been diagnosed before operation. A carefully taken history and several laboratory tests should give the clue to a possible presence of this disease (pain in the upper abdomen, radiating toward the left, & Heid's zone on the left).

The roentgenograms in a case described showed multiple calculi distributed through the upper abdomen in an arch-like fashion, the arch being open on the lower aspect. Barium in the stomach and duodenum showed the position of the stones as typical for the pancreatic region. Calcified mesenteric glands must be differentiated from them.

H W HEFKE, M D

The Mechanism of Gastric Evacuation J Earl Thomas Jour Am Med Assn, Dec 5 1931, XCVII, 1663-1668

There is quite general agreement on the main features of the gastric motor function. The characteristic motility of the stomach is a form of peristalsis, beginning as feeble contractions of the gastric musculature and furnishing the power which drives the chyme through the pylorus into the duodenum. There is definite evidence of opening of the pylorus with each wave of peristalsis.

Cannon found that chyme does not pass the pylorus at the approach of every peristaltic wave but occasionally, at irregular intervals. McCann was convinced that gastric evacuation depends on progressive relaxation of the pars pylorica, which he attributed to a change in irritability brought about by variations in the character of the gastric contents, chiefly digestion of protein. The character of the intragastric stimuli so far found to have an effect on the emptying process indicates that they are mainly concerned with delaying evacuation until a satisfactory degree of digestion has been attained. Available facts indicate that the principal function

of the pyloric sphincter is to furnish this resistance. Gastric evacuation occurs whenever the intragastric pressure near the pylorus exceeds the resistance due to the sphincter. Regulation results from stimuli due to conditions within the stomach and within the small intestine. The tonus of the pyloric sphincter is chiefly determined by stimuli affecting the stomach muscle as a whole. It serves as a constant resistance to the passage of chyme and blocks the exit of solid particles. By maintaining a narrow orifice it "filters" the gastric contents. By contracting when the duodenum contracts, it also limits regurgitation.

CHARLES G SUTHERLAND, M D

Gastro-intestinal Allergy Albert H Rowe Jour Am Med Assn, Nov 14, 1931, XCVII, 1440-1445

Gastro-intestinal symptoms in allergic patients have been noted by many observers. Food allergy probably produces more symptoms in the gastro-intestinal tract than in any other part of the body, because of the contact of foods with the tissues. It occurs most frequently in infancy and childhood and is apt to persist for many years. Edema of the mucous membrane and spasm of the smooth muscle produce disturbances in peristalsis and in function. Hepatic reactions are not infrequent. Allergic reactions in the urogenital tract, including the uterus, may also produce abdominal distress and pain. Symptoms may be immediate, delayed, or cumulative. Mild alimentary symptoms are undoubtedly more frequent than the marked or severe ones. Peptic ulcer in some patients may result from the action of digestive ferments in canker-like lesions in the gastric or duodenal mucosa.

Roentgen studies in 150 patients were negative, except for a spastic colon in twelve and moderate duodenal stasis in five. Roentgen studies with a milk vehicle for the barium are contra-indicated. When mild allergy is present, marked disturbance in function and peristalsis is apt to result.

Treatment consists of elimination of the specific foods productive of allergy. Desensitization to allergy-producing foods may occur in a few weeks or months with their total exclusion from the diet.

C G SUTHERLAND, M D

Common Anomalies of Duodenum and Colon Their Practical Significance Result of Eight Years' Combined Clinical and Roentgen Study John L Kantor Jour Am Med Assn, Dec 12, 1931, XCVII, 1785-1791

This study covers an eight-year period of a consecutive series of private patients complaining of digestive disorders.

Duodenal bands represent anatomically the unabsorbed portion of the free edge of the lesser curvature and are variously called hepatoduodenal, hepatocolic or cystocolic ligaments, depending on the

actual course of the anomalous membranes. When the first portion alone is involved, various deformities of the cap are observed roentgenologically. Bands involving the second portion of the duodenum cause a characteristic roentgen appearance. The most common associated anomaly is a low cecum. Most of the bands in the right upper quadrant are undoubtedly of congenital origin. Acquired adhesions may also occur.

Redundant colon (dolichocolon) is one which is too long to fit into the body of the owner, without undergoing reduplication. The most common variety is an enlarged sigmoid loop. Two subvarieties are encountered often enough to receive the descriptive terms "double splenic flexure, with straight efferent loop" and "pelvic loop to the right." Kinks of the colon, presumably due to adhesions, are rather frequent. In many, the stomach is displaced or deformed, resulting in "cascade" or "retort-shaped" stomach.

High cecum is the result of arrest in embryologic descent, low cecum being the result of embryologic hyperdescent. The chief clinical aspects of each are discussed, and the general significance of digestive anomalies is summarized.

CHARLES G. SUTHERLAND, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

True Prostatic Calculi. Joseph A. Lazarus and Arthur A. Rosenthal. *Urol and Cutan Rev*, February, 1932, XXXVI, 99-102.

A review of the literature revealed records of 370 cases of prostatic calculi, exclusive of the present series of 15 cases reported by the authors. It is believed, however, that many cases are not reported and that, therefore, this number is not a true index of the incidence of the condition. The introduction of roentgenography in routine urologic studies has shown it to be a rather common condition.

Prostatic calculi may be divided into the endogenous, or those calculi formed in the substance of the gland, and exogenous, which are formed in the urologic system and deposited in the prostate. The authors' series included only endogenous or true prostatic calculi.

The diversity of opinion regarding the etiology of prostatic calculi is an admission of failure in the discovery of the true causative factor. Sir Harry Thompson, in 1861, maintained that the corpora amylacea may under certain conditions lead to inflammatory changes within the prostatic acini, in which there occurs a deposition of calcium salts with the resultant formation of concretions. Trauma is believed to play an important rôle. Judd and Crenshaw are of the opinion that prostatic calculi result from a pre-existing prostatitis complicated by hyper-

trophy. In about 30 per cent of the cases, a positive history of gonorrhea is obtained. A pre-existing or existing infection within the gland in an individual who possesses a tendency to calcium deposits seems to the authors to be the most plausible cause for calculous formation in the majority of cases.

Prostatic calculi vary in size, consistency, and in their chemical constituents. The nucleus usually consists of an albuminoid substance, such as epithelial detritus, blood clot, a clump of bacteria, corpora amylacea, or necrotic tissue as a result of abscess formation. The surrounding laminated layers are made up of calcium phosphate, calcium carbonate, calcium oxalate, and ammonium magnesium phosphate. Most calculi are found in the lateral lobe and occasionally in the median lobe.

The symptoms of this condition in the order of their relative importance are as follows: Frequency, dysuria, perineal, penile, and rectal pain, urgency and tenesmus, hematuria, retention, impotencia, and hematospermia. Many calculi, particularly those deeply embedded in the gland, are asymptomatic and are accidentally discovered in a routine urologic study, with the aid of X-rays and digital examination. On digital examination a sensation of stony-hard substance, with crepitation, is diagnostic of this condition. Radiography, in addition to establishing the diagnosis, also indicates the position, size, and number of calculi present. Cystography will prove of value in cases in which it is difficult to ascertain whether the calculi are in the bladder or prostate.

Chronic prostatitis, with hard nodular inflammatory or malignant infiltrations, may often be mistaken for prostatic calculi, but cystoscopic and X-ray examinations usually suffice to make the differential diagnosis. Tuberculosis, with calcification of the prostate, often simulates prostatic calculi. In the case of tuberculosis, the associated involvement of other organs and the presence of tubercle bacilli in the urine aid in the diagnosis.

The treatment of prostatic calculi depends upon the presence of symptoms. In the symptomless case, surgical interference is contra-indicated and diathermy and massage are recommended. Suprapubic prostatectomy is the procedure of choice when an adenoma is found associated with prostatic calculi.

J. N. ANÉ, M.D.

Fibrin Stones of the Urinary Tract. Report of Two Cases. Neil S. Moore. *Urol and Cutan Rev*, February, 1932, XXXVI, 90-93.

Fibrin stones of the urinary tract are considered by most authors to be a very rare condition. The first case was reported by Marcell, in 1817, and up to 1930, 26 cases, which were found at operation or autopsy, had been reported. The author describes two additional cases of this condition.

Fibrin stones have been thought to result from

blood clots, masses of coagulated inflammatory exudate, clumps of bacteria, and pus, or from true stones which have lost their mineral matter. Infection of the colon bacillus group is a constant finding in these cases. Ikoma considers faulty metabolism of great importance in the etiology.

The consistency of fibrin stones is that of putty. A definite capsule is usually present and the stones may be faceted. While the stones are more commonly found in the kidney pelvis in large numbers, they are occasionally encountered in the bladder, in which case they are fewer in number and larger in size.

Since fibrin stones are almost always accompanied by infection, the symptoms are those of pyelonephritis. Roentgenograms fail to reveal definite shadows of the stones, however, in one of the author's cases, negative shadows resembling gas bubbles were noted, and in Pedroso's case, negative shadows were observed on the pyelogram.

The treatment is limited to either pyelotomy or nephrotomy. In the opinion of the author, nephrectomy is the operation of choice in those cases in which a normal kidney is present on the opposite side.

J. N. ANE, MD

Two Cases of "False Route" Determined by Urethrography Italo Levi Archivio Italiano di Dermatologia, Sifilografia e Venereologia, November, 1931, VII, 501-505

Radiographic examination of the urethra is not only useful in many cases but even indispensable. Such cases include all forms of chronic blennorrhea, in which urethrography brings into evidence lesions not easily subject to diagnosis by other methods, both as regards affections of the urethra itself as well as alterations in the glandular adnexa. Fröhwald was thus able in numerous cases of chronic blennorrhea to demonstrate small abscesses of the prostate which were not observable clinically. Indeed, the prostate appeared even normal under clinical examination.

The most positive indication for roentgenographic examination of the urethra is seen in cases of stricture, especially those resulting from gonorrhoea, less frequently those of syphilitic origin. Urethrography furnishes an exact picture both of the nature and extent of the stricture, and reveals the eventual presence of numerous strictures at different points. In addition, the physician is made aware of the existence of so-called "false routes," into which the sound may penetrate, giving rise to serious disturbance, and even to hemorrhage. Determination of the existence of these "false routes" before employing the sound is of the greatest practical importance, and may lead to a complete change of treatment.

As regards harmlessness of the procedure, despite

the fact that a considerable quantity of lithium iodide entered the blood circulation, the author states that patients suffered no marked disturbance, beyond a pronounced metallic taste noticed immediately after the urethrography and persisting for several hours. Likewise, locally there were no inflammatory symptoms resulting from the lithium iodide.

W. W. WHITELOCK, Ph.D.

Renal Hematuria from the Standpoint of the Roentgenologist Ira H. Lockwood Urol and Cutan Rev., February, 1932, XXXVI, 84-88

The author emphasizes the importance of renal hematuria in the symptomatology of many genito-urinary conditions. Very often a patient complaining of hematuria is referred to a roentgenologist, and when no stone is found, the physician and the patient minimize the importance and gravity of this symptom. Also, because the bleeding is usually intermittent and of transitory nature, both are lulled into a condition of false security, and the opportunity for the early recognition of incipiency is lost, irreparable damage resulting. While blood in the urine does not always mean the presence of organic disease in the genito-urinary tract, hematuria in any case should be considered always of sufficient importance to indicate a careful and thorough examination in an effort to determine the nature of the bleeding.

The sources of the bleeding may be considered as intrinsic and extrinsic lesions of the genito-urinary tract, systemic causes, and essential hematuria. The most common causes of renal hematuria are tuberculosis, calculus, infection, and tumors. The author reports five cases, which illustrate various sources of hematuria, and the diagnostic and therapeutic methods employed.

J. N. ANE, MD

Cholecystitis and Cystic Duct Obstruction Significance in the Formation of Gallstones Rich in Calcium Carbonate and in Calcification of the Gall-bladder Wall Preliminary Report D. B. Phemister, Allan G. Rewbridge, and Hillier Rudisill Jour Am Med Assn., Dec. 19, 1931, XCVII, 1843-1849

This is a review of seven cases showing the significance in the formation of gallstones rich in calcium carbonate and in calcification of the gall-bladder wall. The observation was made that in every case the cystic duct was obstructed by a cholesterol-bile pigment or cholesterol stones, indicating that the duct obstruction was a precursor to and a determining factor in calcium carbonate stone formation in the gall bladder. Following obstruction calcium carbonate was thrown out in large quantities. It appears that the order of development of changes was First, there was cholecystitis and cholesterol or cholesterol-pigment stone formation. Calcium car-

bonate and a trace of calcium phosphate were then excreted by the wall of the gall bladder, forming a semi-solid to soft white stone, incorporating other stones when they were present. The indications are that calcium carbonate stones are formed only when bile is excluded from the gall bladder by the obstructing stone, or when the amount entering is greatly reduced.

No explanation has been found for the selective excretion of calcium carbonate over long periods of time in such cases. The assertion that the calcium carbonate of all gallstones is proved out in connection with the mucus formed by the epithelium of the gall bladder is supported by the fact that calculi are occasionally found in the salivary ducts and pancreas, where there is also mucous secretion.

C G SUTHERLAND, M D

A New Case of Double Ureter Pedro Moreyra Bernan La Prensa Med Argentina, Dec. 20, 1931, XVIII, 939-946

Abnormalities of the kidney and ureter, which are frequently encountered, may be the cause of functional disturbances and may modify the symptoms and diagnosis of renal lesions. For that reason, the author gives a review of the different abnormalities, particularly of the ureter. He then proceeds to present the case of a woman, 25 years of age, who came to him sixteen months after giving birth to a child. She complained of backache and pain after urination. These symptoms had not caused much discomfort until three months prior to admission to the hospital, when they gradually became aggravated. There was blood after urination, which occurred five times nightly. On physical examination, there was found tenderness all over the abdomen but particularly over the right kidney region and the left iliac fossa. Cystoscopy revealed two distinct ureters on the right side of the trigone, one higher than the other, urine was collected from the one on the left. A pyelogram was made and the two ureters were found to be independent in their courses from the kidney to the bladder.

In this case, a correct diagnosis could not possibly be made on the symptoms, which pointed to a chronic pyelitis and cystitis. The pain in the right renal area was probably caused by a mild degree of hydronephrosis in the inferior pelvis. The patient improved rapidly by means of cystoscopies and lavage of the two right kidney pelvis with silver nitrate.

N G GONZALEZ, M D

The Significance of Hematuria, with Special Reference to Early Diagnosis William J Wallace Urol and Cutan Rev, February, 1932, XXXVI, 79-82

Hematuria is often the first evidence of major pathology in the genito-urinary tract and may precede subjective and physical manifestations by many

weeks, months, or years. While the causes of hematuria are numerous, the vast majority can be traced to one of the following: Inflammation, tuberculosis, calculus, newgrowths, and trauma. Blood is also found in the urine in many systemic diseases and as the result of poisoning by certain chemicals.

The discovery of the cause of hematuria and the diagnosis of the primary condition require a careful and complete study of the individual case. The family history is of considerable importance, for conditions such as hemophilia, tuberculosis, blood dyscrasias, purpura, or cancer may be disclosed. The personal history should be complete in regard to previous systemic conditions in general and to genito-urinary inflammatory diseases, trauma, and abnormalities in particular. The age and occupation of the patient should always be recorded. The character of the bleeding is a very significant part of the history, and its mode of onset, duration, frequency, amount, and the presence or absence of associated pain should be carefully considered.

The physical examination should be complete with careful attention to every detail. Rectal examination should be made in every case and the prostate carefully examined in all male patients. Vaginal examination and palpation are of equal importance in females. Pathologic involvement of the tubes, ovaries, or uterus can be thus investigated.

Endoscopic examination should be the next procedure in cases of hematuria. The author believes that this procedure can be rendered practically painless by giving sodium amyta by mouth half an hour previous to commencing. This is followed by urethral instillation of a dependable surface anesthetic. After thorough endoscopic examination, the cystoscope is substituted for the endoscopic instrument. X-ray catheters are passed then to the renal pelvis on either side, and a specimen of urine collected from each side. Functional tests should be made to obtain additional information regarding the state of each kidney. Thereafter, a roentgenogram of the entire urinary tract should be made, and this followed in turn by a pyelographic examination. A third exposure is advised, with the patient in the semi-erect position and the opaque catheters partially withdrawn until their tips are about an inch above the ureteral orifice. In the opinion of the author, intravenous pyelography should not be depended upon alone, but should be employed merely as a check for retrograde pyelography.

J N ANE, M D

GENITO-URINARY TRACT (THERAPY)

The Basis for Management of Ureteral Calculi Based on the Study of Five Hundred and Sixty-five Cases Ralph L Dourmashkin Jour Am Med Assn, Jan 23, 1932, XCIVII, 276-283

This series represents 589 stone problems. A

blood clots, masses of coagulated inflammatory exudate, clumps of bacteria, and pus, or from true stones which have lost their mineral matter. Infection of the colon bacillus group is a constant finding in these cases. Ikoma considers faulty metabolism of great importance in the etiology.

The consistency of fibrin stones is that of putty. A definite capsule is usually present and the stones may be faceted. While the stones are more commonly found in the kidney pelvis in large numbers, they are occasionally encountered in the bladder, in which case they are fewer in number and larger in size.

Since fibrin stones are almost always accompanied by infection, the symptoms are those of pyelonephritis. Roentgenograms fail to reveal definite shadows of the stones, however, in one of the author's cases, negative shadows resembling gas bubbles were noted, and in Pedroso's case, negative shadows were observed on the pyelogram.

The treatment is limited to either pyelotomy or nephrotomy. In the opinion of the author, nephrectomy is the operation of choice in those cases in which a normal kidney is present on the opposite side.

J. N. ANE, M.D.

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J. N. ANE, M.D.

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ing sensation locally and along the course of the vein. This sensation—thought to be due to a local action of the drug on the endothelium—has disappeared when the injection is stopped. The authors do not recommend prolonging the time of the injection because of the rapid elimination of the dye by the kidneys. They report the best results when the films are exposed from 10 to 15 minutes after the end of the injection.

In order to obtain good pyelograms it is necessary that the renal function be good. The intensity of the pyelogram depends directly upon the renal function. When there is a lesion of the kidneys bilaterally, the shadow either is opaque or does not show at all. Naturally the intensity of the shadow depends on the concentration of the dye in the urine, a concentration of at least 5 per cent being necessary for good results. When sodium bromide is used, a concentration of 20 per cent is required. If there is an obstruction to the urine flow, the shadows above this obstruction will be more intense because of the urine concentration. Another point in favor of uroselectan is the fact that when it is used the urinary tract is studied in its normal physiologic condition. This is not true of the catheter method of pyelography. When one compares the intravenous with the catheter method, one cannot fail to favor the former.

By means of the above method the authors have found the following changes to occur:

(1) Obstruction to the urine flow at the level of the innominate line. This they believe to be due to the uterine compression on the ureters as they cross the pelvis.

(2) Dilatation of the ureters above the compression. This they attribute to the retarded flow of urine.

(3) There is a compensatory change between the two ureters. When one is dilated, the other is found to have a smaller diameter in proportion.

JOSEPH MALDONADO, MD

Six Hundred Hysterosalpingographies Diagnostic Errors and Dangers Günter K F Schultze Röntgenpraxis, Dec 15, 1931, III, 1105-1108

Of 600 hysterosalpingographies, 250 were checked by surgery and 200 by repeated examinations. Technical errors were responsible for 90 per cent of all wrong diagnoses; they consisted of too small a filling (too little lipiodol) or too large a filling, the examiner having neglected to watch the injection with the fluoroscope and to take a roentgenogram twenty-four hours afterwards. The percentage of diagnostic errors naturally decreases with the technique and experience of the examiner. A correct diagnosis, as far as the structure and pathology of the tubes is concerned, may be made in over 90 per

cent of cases. The diagnosis of a myoma of the uterus can be made in over 80 per cent of all cases, and of ovarian tumors in only about 50 per cent. In 8,300 hysterosalpingographies, done with iodized oils, and reported in the literature, three deaths and 30 inflammatory complications were reported. The actual percentage of harmful sequences is probably greater. No deaths took place in this series, and inflammatory complications were seen five times, which, however, did not lead to permanent damage.

To avoid complications one should make a careful selection of cases, should examine in the middle menstruation cycle, and should use lipiodol as contrast material. The injecting should be done under the fluoroscope, no intra-uterine instruments being used, and no force being employed. The amount of oil should be as small as possible and the uterus should be emptied. After the examination, bed-rest should be advised. If these points are remembered and followed, this method gives very satisfactory results.

H W HEFKE, MD

Hysterosalpingography as a Help in Gynecology A Roentgenologic and Clinical Study S W Leibow and Dr Goldstein Rontgenpraxis, Jan 1, 1932, IV, 16-31

The authors review 61 hysterosalpingographies which they had performed. This method is very valuable, giving information about anatomy and function of the uterus and tubes. The diagnosis of gynecologic diseases is made clearer by it, and anomalies of the uterus might be graphically demonstrated.

The peristalsis of the tubes seems to take place in three ways, wavelike, pendulum type, and the "ballstring" type. An early pregnancy can be shown, but the method should, at present, be used only in cases in which a therapeutic abortion is indicated. Repeated films, taken at not too long intervals, seem necessary in order to show a spasm of the tubes. If such spasm of the uterine end of the tubes is suspected, only a small amount of lipiodol or iodipin (about 2 c.c.) should be injected under low pressure.

The advantage of lipiodol injection over Rubin's air test is that it shows much more than only the patency or occlusion of the tubes. Surgery seems indicated only when the abdominal end, not other portions, of the tube is occluded. If one irradiates the ovaries without effect, this method can locate the ovary. It can be done without danger very easily, if technically correct and with the right indication, without confining the patient to the hospital. There will probably be many more facts found by its use in anatomy, physiology, and pathology of the uterus and tubes.

H W HEFKE, MD

stone may be lodged in a ureter for a considerable length of time without seriously hampering kidney drainage and without producing pelvic infection or extensive changes, marked by hydronephrosis or a chemical pyelonephritis. The routine injection of opaque solutions into the renal pelvis in the presence of ureteral obstruction should always be regarded as a procedure pregnant with dangerous possibilities. With the advent of intravenous pyelography a new, practically harmless medium for obtaining information, regarding changes taking place above the obstructing stone, immediately has become available. In addition, it determines the all-important fact relative to maintenance of renal function. Temporary cessation of renal function may produce a total absence of the dye shadow in the affected side. These should not be mistaken for cases of serious renal obstruction. An indwelling catheter will, as a rule, quickly restore the *status quo* of renal function.

C G SUTHERLAND, MD

GRENZ RAYS

Grenz-ray Therapy Alfred Reisner Röntgen-praxis, Jan 1, 1932, IV, 7-10

A critical study of the value of the Grenz rays is possible only when one confines oneself to the publications which are based on exact measurement of quality and quantity of the radiation. The author uses 0.02 mm Al half value layer, 10 kilovolts, and 10 ma, the distance is 10 cm in localized, and 15 cm in general, irradiation. A single dose of 5,000 r did not cause epilation.

The question of their separation in biologic action from ultra-violet and roentgen rays is not settled. Treatment of superficial diseases of the skin has been greatly improved by the utilization of these rays. Even if X-rays and Grenz rays lead to the same improvement, the Grenz rays ought to be preferred, because the deeper tissues are not affected by them. Superficial nevi can be made to disappear. Tuberculous diseases of the skin require high doses. Carcinoma of the skin should not be treated by Grenz rays, but by roentgen and radium rays. The general action of Grenz rays on the entire body, used in generalized skin diseases and internal diseases, has not been definitely proven as yet in the author's opinion.

H W HEFFE, MD

Grenz-ray Therapy in Dermatology E Lachmann and L Loewenstein München med Wechschr, Oct 16, 1931, LXXVIII, 1793-1795

The authors give a general view of the physical properties of the Grenz rays and of their indications. The rays are a valuable addition in the therapeutic armamentarium of the dermatologist.

E A MAY, MD

GYNECOLOGY AND OBSTETRICS

Renal Pelvis and Ureteral Changes during Pregnancy F Carreras, F Farxat, and I Figueras Rev Med Cubana, January, 1932, XLIII, 75-81

A previous piece of work on this subject gave the authors the thought that there must be some changes taking place in the kidney pelvis and ureters during pregnancy. These changes, the authors believe, are predisposing factors in the causation of pyelitis, which is reported in the literature to occur in from 40 to 66 per cent of the cases of pregnancy, varying according to the author reporting. Most of the authors report the condition as occurring more frequently on the right side. Kretschmer and Heaney believe it occurs in from 80 to 85 per cent of cases. By means of cystoscopy, ureteral catheterization, and pyelography, Carson reports that the capacity of the right ureter changes from 13 c.c. to 100 c.c., and the left side increases to 80 c.c. during pregnancy. The changes found at examination and at autopsy are Dilatation, change in course, strangulation, and kinking.

The changes in position are due to a compression of these structures by the uterus. With normal fetal position, there is an increase in pressure to the right, which accounts for the more frequent changes on this side. The authors have also noted a change that varies from a constriction to a kink, which is usually found just a few centimeters below the kidney pelvis. This they believe to be due to a compensation, with the dilatation below.

The compression of the ureters against the innominate line is not recognized by the authors, but they are of the same opinion as Beaufond, Porcher, Legueu, and Vaudescal, namely, that it is due to a lack of contractility of this part of the ureters. This is more evident when one considers the changes in texture of the ureteral walls. There is a definite rigidity of the walls produced by an increase in tissue of a non-contractile nature. A hyperplasia of the walls is also observed.

In the technic of this study the authors used uroselectan exclusively, because the drug is excreted entirely by the kidneys. After describing the composition of and mechanics of the action of uroselectan, they describe their technic in detail. In doing uroselectan pyelography the authors recommend the following. The colon must be thoroughly clean, as when exploratory pyelography is done. They use 30 gm of the drug dissolved in 100 c.c. bidistilled water. After this solution is sterilized in the autoclave, it is injected intravenously either by means of a syringe or by the Murphy drip. The drug is injected slowly, but not so slowly as when gallbladder visualization is done. The authors take from 10 to 15 minutes to inject the solution. In this way, they have not experienced much reaction. The only complaint that patients have made is of a burn-

the specialist but also to the general practitioner. Lately, there has been great progress made in osteo-articular surgical pathology, with predilection to the coxofemoral articulation, but this knowledge has been imparted only to the specialist. Sometimes, the diagnosis of an infectious process is made, but the family is restless, a complete clinical and radiologic examination is made and syphilitic osteitis diagnosed, thus changing the whole treatment.

Since this subject is so extensive, the purpose of the author is to present certain fundamental conditions, such as the classification of the diverse syndrome of the hip and the corresponding physiopathologic conclusions. He then presents the teachings of Allison, concerning articular pathology and physiology. He believes that the advent of the X-ray broadens the horizon of medicine, particularly in the pathology of bone. Here, it brought to light new entities or corroborated previous findings. From 1908, when Köhler advanced the matter of epiphysitis, through Perthes, who described osteo-arthritis deformans juvenilis, up to the present, our knowledge has been gradually increasing. The author then discusses the classification of such conditions and concludes that the clinical findings are of no importance in comparison with those of the X-ray.

N G GONZALEZ, M D

Meniscitis of the Knee Joint Extracondylloid Luxation Ricardo Finocchietto and Augusto A. Corvaro La Prensa Méd Argentina, Dec 10, 1931, XVIII, 901-904

Usually a severed meniscus has the tendency to have its free part in the intercondylloid space. The purpose of this paper is to present three observations in which the position adopted by the fractured cartilage was completely the opposite, the free portion of the cut meniscus being outside the surface of the interline, thus forming a true extracondylloid luxation. The first case, a boy 17 years old, fell down in forced left genu valgum. There was great pain in the posterior part of the knee and, later on, tumefaction and other symptoms of meniscal lesion. This type of accident happened three times to the same patient. He was operated on, diagnosis was confirmed, and damage repaired.

The second case, a man 22 years old, while playing football hit his left leg in forced flexion. He felt severe pain which was followed later by tumefaction. The same accident happened twenty days later. The identical condition is above was found on operation.

The third case, a man, 20 years old, while playing football, was hit by the foot of another player on the left popliteal region. He fell down with his leg flexed. There was severe pain in the whole articulation, but within twenty minutes it disappeared.

On examination, there was felt a small posterior tumefaction. He was also operated upon and diagnosis confirmed. The authors conclude their paper by presenting a radiograph of the third case and stating that the two outstanding symptoms are (1) tumefaction of the internal side of the articulation and (2) the "jump sign" of the meniscus (movement of the meniscus when caught between the examining finger and the bone).

N G GONZALEZ, M D

NERVOUS SYSTEM (GENERAL)

Radiotherapy of the Sympathetic System in Certain Cardiovascular Affections L Delherm and Henri Beau Jour d'Rad et d'electrol, July, 1930, XIV, 391-401

Observations on the successful treatment of seven cases of Raynaud's disease were made. In all these cases the cervicodorsal region was irradiated, however, recently peripheral irradiations have been employed with success. Only one case of obliterative arteritis is reported. Considerable improvement occurred after irradiation of Scarpa's triangle and the popliteal space. Successful cases treated by others are noted.

Radiotherapy in Raynaud's disease not only stops the local asphyxia but also causes a cicatrization of the ulcers. Capillary circulation improvement is most marked in recent cases, but not rarely is improvement seen in older ones. When scleroderma accompanies this condition, one can observe the loosening of the derma.

This treatment causes a cessation of the spasm and dilates the collaterals so that the claudications stop, pain is relieved, and the color and temperature return to normal. Positive reaction to a hot foot bath is a good prognostic sign of the efficacy of the treatment. A negative reaction calls for a guarded prognosis.

For the upper extremities, irradiation should include the cervicodorsal region to the second dorsal vertebra for the lower extremities, the region from the tenth dorsal to the second lumbar vertebrae. It is advisable also to irradiate areas all along the vessels of the limb. Two symmetrical fields on each side of the vertebral column FSD 25 cm, filter Al = 5 mm, 400 r at each application, 3 applications a week, from 1,200 to 1,600 r per series a week with at least three weeks' rest after each series. For the irradiation of the extremities it is logical to reduce the filtration (to 2 mm) and the voltage as well. An attempt is made to explain the action of the X-ray and its effect on the sympathetic system and not on a modification of the suprarenal secretion. The action is thought to be due to its inhibitory effect on the intermedio-lateral tract and its

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Multiple Aneurysms of the Aorta in a Six-year-old Girl M Acuña, P Winocur, and G Orosco P La Prensa Méd Argentina, Nov 20, 1931, XVIII, 788-795

This is undoubtedly a very interesting case because of the age of the patient. The family history was suggestive of syphilis. The patient, a six-year-old girl, was always weak. Three months prior to her visit to the authors, she had edema of both ankles, which disappeared after two weeks in bed. Shortly afterward, it was noticed that she was failing in health, had become pale, and developed edema of the feet and ankles, accompanied by urinary disturbances. Physical examination revealed an enlargement of the mediastinum, heart, and liver, tachycardia, and a flattening of the tips of the fingers. The Wassermann reaction was weakly positive. A radiogram of the chest showed an enlarged globular heart. The patient started suffering with a dyspneic attack and died twenty-seven days later. At autopsy the following conditions were found: Multiple aneurysms of the aorta, dilatation of the heart, sclerosis of the auriculo-ventricular valves and of the parietal endocardium, and syphilis of the aorta and pulmonary arteries.

N G GONZALEZ, MD

Aneurysmatic Persistence of the Arterial Canal and Aneurysmatic Dilatation of the Pulmonary Artery Carlos Rodrigue and Antonio Battro La Prensa Med Argentina, Dec 30, 1931, XVIII, 986-995

The authors present this case because of its rarity, and also to show the successful results obtained by clinical studies aided by the X-ray. The case here given was of a woman, 27 years of age, who since childhood has been seized with nocturnal epileptiform attacks. When three years old, she was examined by a physician who stated that she had a murmur over the heart. At twelve years of age, she was examined again and the murmur was not found. She was in perfect health until four years ago, when she started complaining of shortness of breath either while resting or exercising, hemoptysis, and pain over the right shoulder.

When examined by the authors, she was found markedly short of breath, and there was present cyanosis of the lips and conjunctiva on the slightest exertion. In the heart, the first sound was found to be blurred in character, while the second was accentuated. A radiograph showed a rare and peculiar heart shadow, the right border being formed in its superior part by the vertebral column and at its lower part by a rather pronounced arch, corresponding to the right auricle. On the left side, there

is observed an arch which runs upward and outward and extends from the second to the fourth intercostal space, where it becomes continuous with the heart shadow. The heart seems to have been displaced to the left so that it almost touches the lateral chest wall, being rotated to that side. There is also seen a light shadow which seems to separate the inferior border of the heart (right ventricle) from the superior border of the right diaphragm. Several radiographs were taken in different positions and the same shadow of the middle arch was noticed.

By a process of elimination, the diagnosis rested upon aneurysm of the pulmonary artery. The X-ray findings did not warrant that diagnosis, so the authors concluded that they were dealing with an aneurysmatic dilatation of the pulmonary artery and an aneurysmatic persistence of the arterial canal.

N G GONZALEZ, MD

HODGKIN'S DISEASE (DIAGNOSIS)

A Contribution to the Question of Lymphogranulomatosis of the Lungs (Roentgenologic Diagnosis and Treatment) W N Bobretzka and J B Porchownik Röntgenpraxis, Nov 15, 1931, III, 1034-1045

Ten cases of involvement of the lungs by Hodgkin's disease are described. In five cases a biopsy had been done, in one an autopsy and in the other four the clinical picture was so typical as to exclude other diseases. Invasion of the lungs in this disease is not infrequent.

The pathologic changes consist in (1) Specific granulomatous growths, and (2) non-specific secondary changes (compression of bronchial walls, atelectasis, etc.). The roentgen picture is various and not typical; all the signs usually evidenced by other tumors may be present, such as invasion, compression, metastasis, and chronic inflammatory processes. The roentgen examination alone does not allow a diagnosis in many of these cases, and a roentgen appearance of a malignant tumor of the lungs does not always exclude Hodgkin's disease.

A biopsy is indicated if glands are present, otherwise a trial series of roentgen treatments, which usually leads to a quick positive effect, is recommended. The treatment should be done carefully so as to avoid a general reaction. Lymphogranulomatosis of the lungs in the terminal stage is influenced very little.

H W HEPKE, MD

THE JOINTS

Present Concept of the Surgical Pathology of the Hip in Infancy Oscar R Marottoli La Prensa Med Argentina Dec 30, 1931, XVIII, 999-1007

This subject is of great importance, not only to

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cerebral ganglions, also the small perivascular ganglions

There follows a review of the cases of angina pectoris, reported in the literature as treated by irradiation. Three cases are added in which the intensity and frequency of the pain were lessened after irradiation. The same technic as given above was used except that the irradiation was given over the heart and aorta from the back and anteriorly.

B J DELAUREAL, M D

RADIATION

Concerning the Question of the Distribution of Roentgen Intensity in the Body during Deep Therapy Part III—Measurements with the Photographic Method M Dorneich Strahlentherapie, March 9, 1932, XLIII, 441-489

The author has continued his studies concerning "isodoses" and presents in this paper the results of investigations dealing with the development of a reliable photographic method (See *Strahlentherapie*, 1930, XXXVIII, 491, 1931, XLII, 56). The apparatus used is described in detail and the possible sources of error are carefully considered. A few examples of the obtained isodose charts are shown, and their general characteristics are discussed. It appeared that the results of Dessauer's and Vierheller's work (1920) could be confirmed, with the exception of minor deviations. In another article which is to follow soon the entire set of "standard isodose charts" will be published.

ERNST A POHLE, M D, Ph D

Radiotherapy of Blood Diseases G Bignami Strahlentherapie, Jan 9, 1932, XLIII, 43-67

This is a translation of a report presented by the author before the Ninth Italian Congress on Medical Radiology, in Turin. He discusses in great detail all phases of a field which offers many puzzling problems to the radiologist. All types of leukemia and aleukemia, erythrocythemia, lymphogranulomatosis, Gaucher's disease, Mikulicz's disease, chloroma, myeloma, lymphosarcoma, and purpura are discussed. Strict individualization must be regarded as the supreme rule in radiation therapy of blood diseases. In leukemia small or moderate doses seem preferable, if the white count has dropped to about 25,000, an interval in the treatment is usually indicated. Higher doses are recommended for both

polycythemia and Hodgkin's disease. It must be admitted, however, that many radiologists obtain excellent results in lymphogranulomatosis with moderate doses. In purpura the irradiation of the spleen with high doses and of the bones with small doses seems indicated. Pernicious anemia does not respond, in the author's opinion, to radiation therapy.

ERNST A POHLE, M D, Ph D

The Treatment of Chronic Leukemia Franz Bardachzi, Richard Epstein, and Ernst Fiedler Med Klinik, Nov 13, 1931, XXVII, 1671-1674

The technical progress in radiology has been so great that difficulties in applying the desired dose and intensity of X-rays do not exist to any extent. A statement, which is often found in the literature, to the effect that the life of a patient with leukemia is not prolonged, must be corrected. Not to advise roentgenotherapy in these cases is a mistake, which, unfortunately, is still made by some physicians. The authors report 26 cases of myelogenous leukemia and 9 of lymphatic leukemia. In myelogenous leukemias the spleen, bones, liver, or the entire body may be exposed to the X-ray. In previously untreated cases irradiation of the spleen alone is usually sufficient. Serial blood examinations give the indication for the type of treatment. Small repeated doses seem to be tolerated better than larger ones. General reaction must be avoided. An initial dose of one-fourth of an erythema dose is often too large (180 KV effective and a filter of 0.5 mm Cu and 1 mm Al were used). The bones should be irradiated only if the response to splenic irradiation is not marked enough. When the white cells reach 20,000, the treatment should be interrupted. The Teschendorf method of irradiating the entire body, with very small doses and from long distances, seems to give good results in otherwise resistant cases. Irradiation is contra-indicated in the terminal stages. The lymphatic leukemias are treated by softer rays and the bones are not exposed. The localized glandular masses are irradiated by comparatively soft rays in order to avoid damage to the blood-forming organs.

The skeptical view taken by many physicians, as far as the radiologic treatment of leukemias is concerned, is not justifiable, but the task of choosing the right technic for each individual case still remains to be settled.

H W HEFKE, M D

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